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SOUNDING ROCKET INSTRUMENTATION DATA AEROBEE 350, FLIGHT 17.05 GT-GG

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GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND

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SOUNDING ROCKET INSTRUMENTATION DATA

AEROBEE 350, FLIGHT 17.05GT-GG

B. Robert Pincus
Joseph S. Stephenson
Thomas E. Thompson Jr.

Instrumentation Branch
National Aeronautics and Space Administration

April 1971

GODDARD SPACE FLIGHT CENTER
Greenbelt, Maryland

SUMMARY

This document contains a compilation of information on instrumentation of the Aerobee 350 rocket, Flight 17.05 GT-GG. Data were obtained from calibration checks and tests that were made in preparation for the flight, on instrumentation components, both at the factory and at Goddard Space Flight Center.

The purpose of the report is to present tolerances and accuracies of the rocket instrumentation components, furnish a record of instrumentation systems used, show the orientation of the installation of these systems, and to supply the necessary information to be used in the data reduction of post-flight records. It also serves as a permanent record of the flight, to be used by the rocket project-managers in planning future Aerobee 350 rocket flights.

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AEROBEE 350, FLIGHT 17.05 GT-GG

INTRODUCTION

Objectives of this flight were to demonstrate the use of the complete Aerobee Sounding Rocket System for scientific research, and to carry an experiment which would investigate solar and stellar X-ray phenomena. The specific rocket systems and launch conditions to be checked were:

1. Fine Attitude Control System (STRAP III),
2. Payload mechanisms, including YO-YO despin and nose-cone ejection,
3. White Sands launch tower,
4. White Sands wind weighting, and impact prediction,
5. Rocket vehicle performance.

Airborne instrumentation and telemetry, supplemented by ground based Radar and photographic coverage, as well as post-flight inspection of the recovered payload, were used to evaluate the overall rocket performance.

An Aerobee 350 rocket system consists of a two-stage unguided vehicle, a post-burnout Fine Attitude Control System, and a payload recovery system. Power is furnished by a Nike M5E1 solid propellant booster, and a four-engine sustainer that employs pressure-fed liquid propellents. Regulated high-pressure helium provides a controlled flow of inhibited red-fuming nitric acid as the oxidizer. The fuel mixture is aniline/furfuryl alcohol.

To keep the weight low, the sustainer stage features a titanium helium tank, and a cork-covered magnesium tail cylinder. Propellents are carried in a stainless steel tank assembly, and pass to the thrust chambers through four sets of feed lines. Four swept-back wedge-shaped airfoil fins are used to stabilize the sustainer stage.

At White Sands, an Aerobee 350 vehicle is launched from a tower 160 feet in height, at a desired effective quadrant elevation of approximately 88 degrees. Initial acceleration is produced by the booster propulsion, with the sustainer thrust chambers reaching full operating pressure at about T +0.6 seconds. At

T+1.2 seconds, the vehicle leaves the tower with all propulsion systems operating simultaneously.

After the vehicle leaves the tower, it rapidly increases in spin rate to about seven revolutions per second because of the large cant angle of the four booster fins. At T+2.3 seconds, a maximum boost-acceleration is reached, and the thrust of the booster decreases sufficiently for stage separation at T+3.2 seconds. The sustainer continues to burn until approximately T+53 seconds, at which time the maximum acceleration of about ten g's, and a roll rate of 2.4 revolutions per second, are achieved. At T+76.0 seconds payload separation occurs.

Following the experiment portion of the flight, the recovery section of the vehicle re-enters the atmosphere at about 19,000 feet altitude. Stage I is then decelerated by the activation of a recovery system barometric-sensing device, which deploys the paraloon. This stabilizes and reduces the speed of the payload, at about 15,000 feet altitude, and the main parachute is deployed. The final rate of descent is at approximately thirty five feet per second.

Recovery-system operation is initiated when the recovery-system lanyards are pulled at launch. At T+6.0 seconds, the recovery-system timers arm the command system. Should there be reason to abort the flight, it is possible to command "Recovery" immediately after a commanded "Abort" by sending the "Command-Separation" signal. The recovery system utilizes pyrotechnic devices for payload separation, for Stage I decelerator-paraloon deployment, and for final stage decelerator-parachute deployment.

Propellent shut-off valves are installed in both the fuel and the oxidizer feed lines, and are pyrotechnically operated (signal-actuated and electrically fired). These valves can be closed by radio command, to effect an emergency shutdown in the event of erratic rocket performance.

The configuration of the Aerobee 350, Flight 17.05 GT-GG, vehicle is shown in Figure 1.

SECTION I

SYSTEM INFORMATION

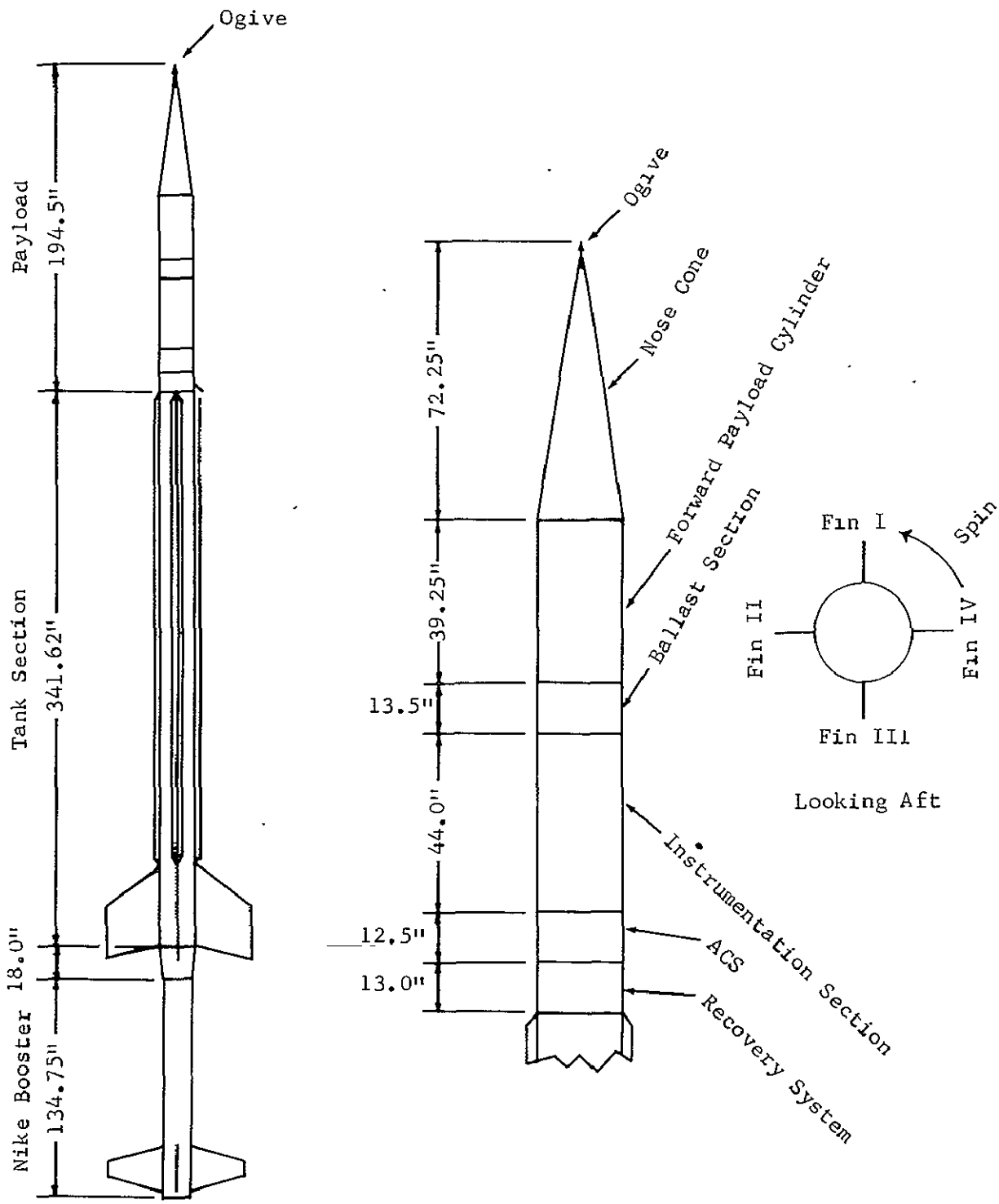

Figure 1. Configuration of Aerobee 350, Flight 17.05GT-GG

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TABLE 1

TELEMETRY SYSTEMS USED FOR FLIGHT 17.05 GT-GG

Telemetry No.	Frequency (MHz)	Measured Power	Deviation (kHz)	Transmission Mode	Location
1	244.3	5 Watts	±125	PAM/FM/FM	Deck 2
2	240.2			PPM/FM	Deck 1
3	258.5			PCM/FM	Deck 5
4	232.9	340 mW	±125	PAM/FM/FM	Fwd Skirt

TABLE 2

TELEMETRY SYSTEM 1 (244.3 MHz), IRIG BAND ALLOCATIONS (PAM/FM/FM)

IRIG Band	IRIG Freq. (kHz)	Frequency Response (Hz)	Allocation	Range
18	70.00	1050	Vibration, Yaw (X) Axis, Recovery System	±50 g
17	52.50	790	Commutator 1	
16	40.00	600	Commutator 2	
15	30.00	450	Strain Gauge 1, or ACS Pitch Valves	0 to 45 (in/lb)3*
14	22.00	330	Strain Gauge 8, or ACS Yaw Valves	0 to 45 (in/lb)3*
13	14.50	220	Strain Gauge 3, or ACS Roll Valves, or Programmer Position	0 to 45 (in/lb)3*
12	10.50	160	Strain Gauge 4, or ACS Pitch Position, or Tracker (high gain)	0 to 45 (in/lb)3*
11	7.35	110	Strain Gauge 5, or ACS Yaw Position, or Tracker (high gain)	0 to 45 (in/lb)3*
10	5.40	80	Strain Gauge 6, or ACS Roll Position	0 to 45 (in/lb)3*
9	3.90	60	Strain Gauge 7, or ACS Pitch Tracker (low gain)	0 to 45 (in/lb)3*
8	3.00	45	Strain Gauge 2, or ACS Yaw Tracker (low gain)	0 to 45 (in/lb)3*
7	2.30	35	Tone Range	

*Strain Gauge

TABLE 3

TELEMETRY SYSTEM 1, COMMUTATOR 1, SEGMENT ALLOCATIONS

CHANNEL 17 (52.5kHz), 5.0r/s

Segment	Allocation	Nominal Value
1	Synchronization	+2.5 Volts dc
2	Ground	—
3	Ogive, Pitch (Y) Axis	±7.5 degrees
4	Ogive, Yaw (X) Axis	±7.5 degrees
5	Accelerometer, BLH 1, Thrust (Z) Axis	±25g
6	Accelerometer, BLH 2, Pitch (Y) Axis	±25g
7	Accelerometer, BLH 3, Yaw (X) Axis	±25g
8	Spare	—
9	Ogive, Pitch (Y) Axis	±7.5 degrees
10	Ogive, Yaw (X) Axis	±7.5 degrees
11	Telemetry 1, 28 Volts dc Monitor	28 Volts dc
12	Telemetry 2, 28 Volts dc Monitor	28 Volts dc
13	Telemetry 3, 28 Volts dc Monitor	28 Volts dc
14	Voltage Regulator Monitor, 28 Volts dc	28 Volts dc
15	Ogive, Pitch (Y) Axis	±7.5 degrees
16	Ogive, Yaw (X) Axis	±7.5 degrees
17	Nose-Tip Separation	—
18	Nose-Tip Separation	—
19	Experiment 1, 28 Volts dc Monitor	28 Volts dc

TABLE 3 (Continued)

TELEMETRY SYSTEM 1, COMMUTATOR 1, SEGMENT ALLOCATIONS

CHANNEL 17 (52.5 kHz), 5.0 r/s

Segment	Allocation	Nominal Value
20	Experiment 2, 28 Volts dc Monitor	28 Volts dc
21	Ogive, Pitch (Y) Axis	±7.5 degrees
22	Ogive, Yaw (X) Axis	±7.5 degrees
23	Magnetometer, Pitch (Y) Axis	±600 milligauss
24	Magnetometer, Thrust (Z) Axis	±600 milligauss
25	Magnetometer, Yaw (X) Axis	±600 milligauss
26	Nose-Tip Eject (Current)	—
27	Ogive, Pitch (Y) Axis	±7.5 degrees
28	Ogive, Yaw (X) Axis	±7.5 degrees
29	Synchronization	+5.0 Volts dc
30	Synchronization	+5.0 Volts dc
31	Spare	—
32	Telemetry 1, Channel 3, Data Out	—
33	Spare	—
34	Spare	—
35	Ground (Power)	—
36	Spare	—
37	+28 Volts dc	+28 Volts dc

TABLE 4

TELEMETRY SYSTEM 1, COMMUTATOR 2, SEGMENT ALLOCATIONS

CHANNEL 16 (40.0kHz), 2.5r/s

Segment	Allocation	Nominal Value
1	Synchronization	+2.5 Volts dc
2	Ground	—
3	Experiment, Detector Pressure	—
4	ACS, System Mode	—
5	ACS, Camera Pulser	—
6	ACS, Roll Rate	—
7	ACS, Pressure (low)	—
8	ACS, Pressure (medium)	—
9	ACS, Pressure, Tank	—
10	ACS, Temperature, Tank	—
11	ACS, Despin	—
12	ACS, Roll Rate	—
13	Strain Gauge 1	0 to 45 $(in/lb)^3$
14	Strain Gauge 8	0 to 45 $(in/lb)^3$
15	Strain Gauge 3	0 to 45 $(in/lb)^3$
16	ACS, Camera Pulser	—
17	Experiment 2, High Voltage Monitor	—
18	Strain Gauge 4	0 to 45 $(in/lb)^3$
19	Strain Gauge 5	0 to 45 $(in/lb)^3$

TABLE 4 (Continued)

TELEMETRY SYSTEM 1, COMMUTATOR 2, SEGMENT ALLOCATIONS

CHANNEL 16 (40.0kHz), 2.5r/s

Segment	Allocation	Nominal Value
20	Strain Gauge 6	0 to 45 $(in/lb)^3$
21	Strain Gauge 7	0 to 45 $(in/lb)^3$
22	Strain Gauge 2	0 to 45 $(in/lb)^3$
23	Experiment, 3.5 Volts dc Monitor	3.5 Volts dc
24	Experiment, 3.5 Volts dc Monitor	3.5 Volts dc
25	Experiment, Detector Pressure	—
26	Experiment, Temperature 1	—
27	Experiment, Temperature 2	—
28	Experiment, Temperature 3	—
29	Synchronization	+5.0 Volts dc
30	Synchronization	+5.0 Volts dc
31	Spare	—
32	Telemetry 1, Channel 4, Data Out	—
33	Spare	—
34	Spare	—
35	Ground	—
36	Spare	—
37	+28 Volts dc	+28 Volts dc

TABLE 5

TELEMETRY SYSTEM 1, CALIBRATION DATA

VCO Freq. (kHz)	VCO Serial No.	Lower Band Limit		Center Frequency			Upper Band Limit	
		Frequency (Hz)	Noise Peak to Peak (Volts dc)	Frequency (Hz)	Discrim. Input (Volts dc)	Noise Peak to Peak (Volts dc)	Frequency (Hz)	Noise Peak to Peak (Volts dc)
70.00	15110	64.749	.020	70.002	.700	.030	75.277	.020
52.50	16562	48.515	.020	52.466	.480	.020	56.429	.020
40.00	20344	37.020	.020	40.014	.310	.020	43.014	.020
30.00	16404	27.738	.020	29.980	.260	.020	32.230	.025
22.00	16262	20.359	.030	22.004	.200	.025	23.656	.035
14.50	16180	13.387	.030	14.469	.130	.020	15.555	.020
10.50	16106	9.713	.040	10.502	.080	.035	11.298	.045
7.35	15972	6.796	.020	7.345	.070	.025	7.903	.025
5.40	15402	5.000	.020	5.406	.080	.020	5.811	.015
3.90	15737	3.627	.035	3.917	.060	.010	4.219	.010
3.00	15662	2.776	.010	3.002	.065	.010	3.229	.010

TABLE 5 (Continued)

TELEMETRY SYSTEM 1, CALIBRATION DATA

System Parameter	Measurements at Power Supply Voltages of:		
	+26 Volts dc	+30 Volts dc	+32 Volts dc
Receiver Video Output (P to P)	5.0	5.0	5.0
Transmitter Frequency (MHz)	244.284	244.284	244.284
Transmitter Output Power (Watts)	6.0	5.0	6.5

TABLE 6

TELEMETRY SYSTEM 2 (240.2 MHz), CHANNEL ALLOCATIONS (PPM/FM)

Channel	Allocation	Range
1	Current Monitor (biological)	—
2	Acceleration, Pitch (Y) Axis	±25g
3	Acceleration, Yaw (X) Axis	±25g
4	Acceleration, Thrust (Z_2) Axis	-1 to +15g
5	Stable Platform, Pitch (Y) Axis	360 degrees
6	Stable Platform, Roll (Z) Axis	360 degrees
7	Stable Platform, Yaw (X) Axis	±85 degrees
8	Pressure, Manifold (Pman)	0 to 15 psia
9	Pressure, Body (Pb1)	0 to 15 psia
10	Pressure, Body (Pb2)	0 to 15 psia
11	Pressure, Body (Pb3)	0 to 15 psia
12	Solar Aspect Sensor	44.5 degrees (Ret. A) 57.5 degrees (Ret. B)
13	Commutator 3	—
14	Commutator 4	—
15	Camera Monitor	—
16	Payload Acceleration, Thrust (Z) Axis	±25g

TABLE 7

TELEMETRY SYSTEM 2, COMMUTATOR 3, SEGMENT ALLOCATIONS

CHANNEL 13, 2.5 r/s

Segment	Allocation	Nominal Value
1	Temperature T1	0 to 1200 degrees F
2	Temperature T2	0 to 1200 degrees F
3	Temperature T3	0 to 1200 degrees F
4	Temperature T4	0 to 1200 degrees F
5	Temperature T5	0 to 1200 degrees F
6	Temperature T6	0 to 1200 degrees F
7	Temperature T7	0 to 1200 degrees F
8	Temperature T8	0 to 1200 degrees F
9	Temperature T9	0 to 1200 degrees F
10	Temperature T10	0 to 1200 degrees F
11	Temperature T11	0 to 1200 degrees F
12	Temperature T12	0 to 1200 degrees F
13	Temperature T13	0 to 1200 degrees F
14	Temperature T14	0 to 1200 degrees F
15	Temperature T15	0 to 1200 degrees F
16	Temperature T16	0 to 1200 degrees F
17	Temperature T7	0 to 1200 degrees F
18	Temperature T8	0 to 1200 degrees F
19	Temperature T9	0 to 1200 degrees F

TABLE 7 (Continued)

TELEMETRY SYSTEM 2, COMMUTATOR 3, SEGMENT ALLOCATIONS

CHANNEL 13, 2.5 r/s

Segment	Allocation	Nominal Value
20	Temperature T10	0 to 1200 degrees F
21	Temperature T11	0 to 1200 degrees F
22	Temperature T12	0 to 1200 degrees F
23	Temperature T13	0 to 1200 degrees F
24	Temperature T14	0 to 1200 degrees F
25	Temperature T15	0 to 1200 degrees F
26	Temperature T16	0 to 1200 degrees F
27	Calibration Resistance	200 ohms
28	Calibration Resistance	400 ohms
29	Calibration Resistance	604 ohms
30	Ground	—
31	Spare	—
32	Telemetry 2, Channel 13, Data Out	—
33	Spare	—
34	Spare	—
35	Ground (Power)	—
36	Spare	—
37	+28 Volts dc	+28 Volts dc

TABLE 8

TELEMETRY SYSTEM 2, COMMUTATOR 4, SEGMENT ALLOCATIONS

CHANNEL 14, 2.5 r/s

Segment	Allocation	Nominal Value
1	Synchronization	+2.5 Volts dc
2	Ground	—
3	Magnetometer, Pitch (Y) Axis	±600 milligauss
4	Magnetometer, Thrust (Z) Axis	±600 milligauss
5	Magnetometer, Yaw (X) Axis	±600 milligauss
6	Pressure, Air Reservoir (Par)	0 to 4000 psia
7	Event Marker "A"	—
8	Event Marker "B"	—
9	Magnetometer, Pitch (Y) Axis	±600 milligauss
10	Magnetometer, Thrust (Z) Axis	±600 milligauss
11	Magnetometer, Yaw (X) Axis	±600 milligauss
12	Separation Indicator	—
13	"A" Command (Paraloon)	—
14	"B" Command (Paraloon)	—
15	Magnetometer, Pitch (Y) Axis	±600 milligauss
16	Magnetometer, Thrust (Z) Axis	±600 milligauss
17	Magnetometer, Yaw (X) Axis	±600 milligauss
18	"A" Command Separation	—
19	"B" Command Separation	—

TABLE 8 (Continued)

TELEMETRY SYSTEM 2, COMMUTATOR 4, SEGMENT ALLOCATIONS

CHANNEL 14, 2.5 r/s

Segment	Allocation	Nominal Value
20	Magnetometer, Pitch (Y) Axis	±600 milligauss
21	Magnetometer, Thrust (Z) Axis	±600 milligauss
22	Magnetometer, Yaw (X) Axis	±600 milligauss
23	Switched Power (A)	—
24	Switched Power (B)	—
25	Voltage Regulator Monitor	+12 Volts dc
26	Magnetometer, Pitch (Y) Axis	±600 milligauss
27	Magnetometer, Thrust (Z) Axis	±600 milligauss
28	Magnetometer, Yaw (X) Axis	±600 milligauss
29	Synchronization	+5.0 Volts dc
30	Synchronization	+5.0 Volts dc
31	Spare	—
32	Telemetry 2, Channel 14, Data Out	—
33	Spare	—
34	Spare	—
35	Ground (Power)	—
36	Spare	—
37	+28 Volts dc	+28 Volts dc

TABLE 9

TELEMETRY SYSTEM 3 (258.5 MHz), ALLOCATIONS (PCM/FM)

Channel	Allocation	Range
	Note: Telemetry System 3 was used for Experiment Data, with no Instrumentation Data included.	

TABLE 10

TELEMETRY SYSTEM 4 (232.9 MHz), IRIG BAND ALLOCATIONS (PAM/FM/FM)

IRIG Band	IRIG Freq. (kHz)	Frequency Response (Hz)	Allocation	Range
18	70.00	1050	Vibration, Yaw (X) Axis	±50 g
17	52.50	790	Vibration, Pitch (Y) Axis	±50 g
16	40.00	600	Vibration, Thrust (Z) Axis	±50 g
15	30.00	450	Commutator 5	—
14	22.00	330	Chamber Pressure (PcI)	0 to 600 psia
13	14.50	220	Chamber Pressure (PcII)	0 to 600 psia
12	10.50	160	Chamber Pressure (PcIII)	0 to 600 psia
11	7.35	110	Chamber Pressure (PcIV)	0 to 600 psia
10	5.40	80	Start Valve Monitor I	—
9	3.90	60	Start Valve Monitor II	—
8	3.00	45	Start Valve Monitor III	—
7	2.30	35	Start Valve Monitor IV	—

TABLE 11

TELEMETRY SYSTEM 4, COMMUTATOR 5, SEGMENT ALLOCATIONS

CHANNEL 15 (30.0 kHz), 2.5 r/s

Segment	Allocation	Nominal Value
1	Synchronization	+2.5 Volts dc
2	Ground	—
3	Pressure, Gas Bottle (Pgb)	0 to 4000 psia
4	Pressure, Gas Bottle (Pgb)	0 to 4000 psia
5	Pressure, Gas Regulator (Pgr)	0 to 600 psia
6	Pressure, Gas Regulator (Pgr)	0 to 600 psia
7	Oxidizer Valves, 2nd Motion	—
8	Fuel Valves, 2nd Motion	—
9	Pressure, Gas Bottle (Pgb)	0 to 4000 psia
10	Pressure, Gas Regulator (Pgr)	0 to 600 psia
11	Instrumentation Monitor	+28 Volts dc
12	Oxidizer Valves, 2nd Motion	—
13	Fuel Valves, 2nd Motion	—
14	Pressure, Gas Bottle (Pgb)	0 to 4000 psia
15	Pressure, Gas Bottle (Pgb)	0 to 4000 psia
16	Pressure, Gas Regulator (Pgr)	0 to 600 psia
17	Pressure, Gas Regulator (Pgr)	0 to 600 psia
18	Oxidizer Valves, 2nd Motion	—
19	Fuel Valves, 2nd Motion	—

TABLE 11 (Continued)

TELEMETRY SYSTEM 4, COMMUTATOR 5, SEGMENT ALLOCATIONS

CHANNEL 15 (30.0 kHz), 2.5 r/s

Segment	Allocation	Nominal Value
20	Pressure, Gas Bottle (Pgb)	0 to 4000 psia
21	Pressure, Gas Regulator (Pgr)	0 to 600 psia
22	Instrumentation Monitor	+28 Volts dc
23	Oxidizer Valves, 2nd Motion	—
24	Fuel Valves, 2nd Motion	—
25	Pressure, Gas Bottle (Pgb)	0 to 4000 psia
26	Pressure, Gas Bottle (Pgb)	0 to 4000 psia
27	Pressure, Gas Regulator (Pgr)	0 to 600 psia
28	Pressure, Gas Regulator (Pgr)	0 to 600 psia
29	Synchronization	+5.0 Volts dc
30	Synchronization	+5.0 Volts dc
31	Spare	—
32	Telemetry 4, Channel 15, Data Out	—
33	Spare	—
34	Spare	—
35	Ground (Power)	—
36	Spare	—
37	+28 Volts dc	+28 Volts dc

TABLE 12

TELEMETRY SYSTEM 4, CALIBRATION DATA

VCO Freq. (kHz)	VCO Serial No.	Lower Band Limit		Center Frequency			Upper Band Limit	
		Frequency (Hz)	Noise Peak to Peak (Volts dc)	Frequency (Hz)	Discrim. Input (Volts dc)	Noise Peak to Peak (Volts dc)	Frequency (Hz)	Noise Peak to Peak (Volts dc)
70.00	4369	64.665	.015	69.897	.520	.030	75.121	.030
52.50	15217	48.569	.020	52.499	.450	.020	56.427	.020
40.00	16488	36.989	.020	39.975	.380	.015	42.949	.020
30.00	20337	27.765	.030	30.016	.280	.020	32.258	.020
22.00	16310	20.349	.020	21.976	.220	.020	23.601	.020
14.50	20769	13.407	.015	14.507	.180	.020	15.199	.020
10.50	16085	9.765	.020	10.588	.140	.020	11.317	.020
7.35	15309	6.860	.030	7.388	.120	.020	8.177	.020
5.40	10953	5.156	.030	5.484	.090	.030	5.914	.020
3.90	5944	3.839	.020	4.050	.080	.010	4.378	.020
3.00	15644	3.034	.020	3.149	.080	.020	3.400	.020
2.30	15548	2.447	.020	2.540	.070	.020	2.694	.010

TABLE 12 (Continued)

TELEMETRY SYSTEM 4, CALIBRATION DATA

System Parameter	Measurements at Power Supply Voltages of:		
	+26 Volts dc	+30 Volts dc	+32 Volts dc
Receiver Video Output (P to P)	5.0	5.0	5.0
Transmitter Frequency (MHz)	232.897	232.896	232.896
Transmitter Output Power (Watts)	0.400	0.340	0.340

TABLE 13

INSTRUMENTATION COMPONENTS USED ON FLIGHT 17.05GT-GG

Component	Manufacturer	Model No.	Serial No.
Accelerometer (high frequency), Yaw (X) Axis Signal Conditioning Unit	CEC BLH	4-202-0001 950	8340 061
Accelerometer (high frequency), Pitch (Y) Axis Signal Conditioning Unit	CEC BLH	4-202-0001 950	7105 065
Accelerometer (high frequency), Thrust (Z) Axis Signal Conditioning Unit	CEC BLH	4-202-0001 950	8339 032
Accelerometer (low frequency), Thrust (Z_2) Axis	Conrac	24155F	143-2
Accelerometer, Yaw (X) Axis - Vibration Signal Conditioning Unit	Endevco Endevco	2221E 2641M5	PA17 LA27
Accelerometer, Pitch (Y) Axis - Vibration Signal Conditioning Unit	Endevco Endevco	2221E 2641M5	PB68 LA28
Accelerometer, Thrust (Z) Axis - Vibration Signal Conditioning Unit	Endevco Endevco	2221E 2641M5	PB38 LA24
Accelerometer, Yaw (X) Axis - Vibration (R/S) Signal Conditioning Unit	Endevco Endevco	2221E 2641M5	PB39 LA20
Antennas, TM1 (244.3 MHz)	New Mexico State	2.041	W78, W79
Antennas, TM2 (240.2 MHz)	New Mexico State	2.041	W76, W77

TABLE 13 (Continued)

INSTRUMENTATION COMPONENTS USED ON FLIGHT 17.05 GT-GG

Component	Manufacturer	Model No.	Serial No.
Antennas, TM3 (258.5 MHz)	New Mexico State	2.041	W80, W81
Antennas, TM4 (239.2 MHz)	New Mexico State	2.041	W74, W75
Antennas, Command Receiver (409.0 MHz)	New Mexico State	4.003	W84, W85
Antennas, Tone Range (550.0 MHz)	New Mexico State	4.011	Z94, Z95
Calibrator, TM1 Slave A Slave B	Tempo Tempo Tempo	909702-A 909702-A1 909702-A1	0065 0047 0040
Calibrator, TM2	T-E-C	4X4	048
Calibrator, TM4 Slave	Tempo Tempo	909702-A 909702-A1	0058 0018
Commutator 1, TM1 (5.0 r/s)	Datametrics	953-3	23
Commutator 2, TM1 (2.5 r/s)	Datametrics	886	4
Commutator 3, TM2 (2.5 r/s)	Datametrics	884	2
Commutator 4, TM2 (2.5 r/s)	Datametrics	884	26
Commutator 5, TM4 (2.5 r/s)	Datametrics	951-4	5

TABLE 13 (Continued)

INSTRUMENTATION COMPONENTS USED ON FLIGHT 17.05GT-GG

Component	Manufacturer	Model No.	Serial No.
Filter	Telonic	TLP273-4AA1	A144-6
Magnetometer, Yaw (X) Axis	Schonstedt	RAM-5C	2500
Magnetometer, Pitch (Y) Axis	Schonstedt	RAM-5C	2505
Magnetometer, Thrust (Z) Axis	Schonstedt	RAM-5C	2506
Mixer Amplifier, TM1	Vector	MMA12	11955
Mixer Amplifier, TM4	Vector	MMA12	12100
Ogive	Giannini	2519P	563
Pressure Transducer, Chamber Pressure (PcI)	Servonic	2091-8001	1066
Pressure Transducer, Chamber Pressure (PcII)	Servonic	2091-8001	1075
Pressure Transducer, Chamber Pressure (PcIII)	Servonic	2091-8001	1119
Pressure Transducer, Chamber Pressure (PcIV)	Servonic	2091-8001	1060
Pressure Transducer, Air Reservoir Pressure (Par)	Servonic	2091-9201	1008
Pressure Transducer, Gas Bottle Pressure (Pgb)	Edcliff	2-400, 120165	924

TABLE 13 (Continued)

INSTRUMENTATION COMPONENTS USED ON FLIGHT 17.05 GT-GG

Component	Manufacturer	Model No.	Serial No.
Pressure Transducer, Gas Regulator Pressure (Pgr)	Servonic	2091-8001	1120
Pressure Transducer, Manifold Pressure (Pman)	Gulton	3031-10201	1009
Pressure Transducer, Body Pressure (PbI)	Gulton	3031-10201	1006
Pressure Transducer, Body Pressure (PbII)	Gulton	3031-10201	1007
Pressure Transducer, Body Pressure (PbIII)	Gulton	3031-10201	1008
Pre-Modulator (PPM)	—	SST-3	16
Regulator (5.0 Volts dc), TM1	Vector	TV53-A5	903
Regulator (5.0 Volts dc), TM4	Vector	TV53-A5	855
Regulator (12.0 Volts dc), TM2	GSFC	—	—
Regulator (18.0 Volts dc), TM1	Vector	TV-56A	599
Relay 1, TM1	Tempo	92208	0033
Relay 2, TM1	Tempo	92208	0019

TABLE 13 (Continued)

INSTRUMENTATION COMPONENTS USED ON FLIGHT 17.05 GT-GG

Component	Manufacturer	Model No.	Serial No.
Solar Sensor	Adcole	233C	108
Eye 1	—	—	124
Eye 2	—	—	122
Eye 3	—	—	125
Stable Platform	Whittaker	525145	63-5
Strain Gauge 1 Amplifier	Electro-Dev. Corp.	2-481	735
Strain Gauge 2 Amplifier	Electro-Dev. Corp.	2-481	723
Strain Gauge 3 Amplifier	Electro-Dev. Corp.	2-481	734
Strain Gauge 4 Amplifier	Electro-Dev. Corp.	2-481	730
Strain Gauge 5 Amplifier	Electro-Dev. Corp.	2-481	3074
Strain Gauge 6 Amplifier	Electro-Dev. Corp.	2-481	3076
Strain Gauge 7 Amplifier	Electro-Dev. Corp.	2-481	3035
Strain Gauge 8 Amplifier	Electro-Dev. Corp.	2-481	3042
Switch (g), TM1	Raymond	1962-3	—
Switch (g), TM4	Raymond	1962-3	—

TABLE 13 (Continued)

INSTRUMENTATION COMPONENTS USED ON FLIGHT 17.05 GT-GG

Component	Manufacturer	Model No.	Serial No.
Temperature Sensor, T1	Trans-sonics	67B	81191
Temperature Sensor, T2	Trans-sonics	67B	81199
Temperature Sensor, T3	Trans-sonics	67B	81195
Temperature Sensor, T4	Trans-sonics	67B	81193
Temperature Sensor, T5	Trans-sonics	67B	81192
Temperature Sensor, T6	Trans-sonics	67B	81190
Temperature Sensor, T7	Trans-sonics	67B	81208
Temperature Sensor, T8	Trans-sonics	67B	81210
Temperature Sensor, T9	Trans-sonics	67B	81209
Temperature Sensor, T10	Trans-sonics	67B	81207
Temperature Sensor, T11	Trans-sonics	67B	81211
Temperature Sensor, T12	Trans-sonics	67B	81204
Temperature Sensor, T13	Trans-sonics	67B	81203

TABLE 13 (Continued)

INSTRUMENTATION COMPONENTS USED ON FLIGHT 17.05 GT-GG

Component	Manufacturer	Model No.	Serial No.
Temperature Sensor, T14	Trans-sonics	67B	81187
Temperature Sensor, T15	Trans-sonics	67B	81202
Temperature Sensor, T16	Trans-sonics	67B	81201
Timer (g), TM1	Raymond	1060-5G180	12191
Transmitter, TM1	Vector	T1127	433
Transmitter, TM2	Vector	2125	965
Transmitter, TM3	Vector	T1127	216
Transmitter, TM4	Vector	TRPT-251A	3045
Transmitter, Tone Range Filter	—	RU-1043 BNB-902	134 101
Transmitter, Beacon	—		405
VCO, TM1 (70.00 kHz), IRIG 18	Vector	MM011	15110
VCO, TM1 (52.50 kHz), IRIG 17	Vector	MM011	16562

TABLE 13 (Continued)

INSTRUMENTATION COMPONENTS USED ON FLIGHT 17.05 GT-GG

Component	Manufacturer	Model No.	Serial No.
VCO, TM1 (40.00 kHz), IRIG 16	Vector	MM011	20344
VCO, TM1 (30.00 kHz), IRIG 15	Vector	MM011	16404
VCO, TM1 (22.00 kHz), IRIG 14	Vector	MM011	16262
VCO, TM1 (14.50 kHz), IRIG 13	Vector	MM011	16180
VCO, TM1 (10.50 kHz), IRIG 12	Vector	MM011	16106
VCO, TM1 (7.35 kHz), IRIG 11	Vector	MM011	15972
VCO, TM1 (5.40 kHz), IRIG 10	Vector	MM011	15402
VCO, TM1 (3.90 kHz), IRIG 9	Vector	MM011	15737
VCO, TM1 (3.00 kHz), IRIG 8	Vector	MM011	15662
VCO, TM4 (70.00 kHz), IRIG 18	Vector	MM011	4369
VCO, TM4 (52.50 kHz), IRIG 17	Vector	MM011	15217
VCO, TM4 (40.00 kHz), IRIG 16	Vector	MM011	16488

TABLE 13 (Continued)

INSTRUMENTATION COMPONENTS USED ON FLIGHT 17.05 GT-GG

Component	Manufacturer	Model No.	Serial No.
VCO, TM4 (30.00 kHz), IRIG 15	Vector	MM011	20337
VCO, TM4 (22.00 kHz), IRIG 14	Vector	MM011	16310
VCO, TM4 (14.50 kHz), IRIG 13	Vector	MM011	20769
VCO, TM4 (10.50 kHz), IRIG 12	Vector	MM011	16085
VCO, TM4 (7.35 kHz), IRIG 11	Vector	MM011	15309
VCO, TM4 (5.40 kHz), IRIG 10	Vector	MM011	10953
VCO, TM4 (3.90 kHz), IRIG 9	Vector	MM011	5944
VCO, TM4 (3.00 kHz), IRIG 8	Vector	MM011	15644
VCO, TM4 (2.30 kHz), IRIG 7	Vector	MM011	15548

TABLE 14

SIGNIFICANT PLANNED EVENTS FOR FLIGHT 17.05 GT-GG (Predicted)

Event	Time (seconds)	Velocity (feet/sec)	Altitude (feet)	Range (feet)
Stage I Ignition First Motion, Pullaways Out, Lift-Off	0.0	0	0	0
Tower Exit	1.2	262		
Stage I Burnout and Separation	3.2	704	5,198	39
Stage I Apogee	19.0	16	9,856	350
Stage I Impact	42.1	448	0	506
Stage II Burnout	52.8	7,049	144,251	10,544
Propulsion Valves Shut-Off	68.0		247,000	
Arm the Command and Recovery Systems	70.0		250,000	
Payload Separation	76.0		299,000	
ACS Start, TM Channel Switch, X-Ray High Voltage On, Power to Robot Camera	77.0		305,000	
YO-YO Despin	78.0		311,000	

TABLE 14 (Continued)

SIGNIFICANT PLANNED EVENTS FOR FLIGHT 17.05 GT-GG (Predicted)

Event	Time (seconds)	Velocity (feet/sec)	Altitude (feet)	Range (feet)
Nose Cone Eject	92.0		395,000	
Stage II Apogee	285.3	599	949,278	146,258
ACS Off, TM Channel Switch, High Voltage Off	485.0		357,000	
Recovery System Paraloon Deployment			19,000	
Recovery System Parachute Deployment			15,000	
Stage II Impact	539.9	3,525	4,000	290,480
Expected Roll Rates: At Booster Burnout = 0.7 r/s At Sustainer Burnout = 2.4 r/s				
Coordinates: Latitude Longitude Launcher 32.410° N 106.330° W Sustainer Impact 33.180° N 106.569° W				

TABLE 15

WEIGHTS AND DIMENSIONS OF FLIGHT 17.05 GT-GG VEHICLE

Weights	Pounds
Total Weight of Vehicle at Launch	7363.4
Stage I at Launch	1393.8
Stage II at Launch (including Payload, Propellants, etc.)	5969.6
Total Weight of Vehicle at Stage I Burnout (before separation)	6338.3
Stage I at Burnout	598.8
Stage II at Separation	5739.5
Stage II at Burnout	1652.1
Forward Payload at Separation (prior to nose-tip eject)	691.0
Recovery Body (following nose-tip eject)	640.0
Lengths	Inches
Total Length of Vehicle at Launch	688.87
Booster Stage (including inter-stage structure of 18 inches)	152.75
Sustainer Stage	341.62
Payload (including Ogive)	194.50
Recovery Body	123.00
Diameters	Inches
Booster (Stage I)	16.5
Booster (Stage I) Fin Span	59.6
Sustainer (Stage II)	22.0
Sustainer (Stage II) Fin Span	100.4

SECTION II

VEHICLE ASPECT INSTRUMENTATION

TABLE 16

VEHICLE ASPECT SENSORS FOR FLIGHT 17.05 GT-GG

MAGNETOMETERS

Sensor	Manufacturer	Model No.	Serial No.	Range (milligauss)
Magnetometer: Yaw (X) Axis	Schonstedt	RAM-5C	2500	±600
Magnetometer: Pitch (Y) Axis	Schonstedt	RAM-5C	2505	±600
Magnetometer: Thrust (Z) Axis.	Schonstedt	RAM-5C	2506	±600

STABLE PLATFORM

Sensor	Manufacturer	Model No.	Serial No.	Range (degrees)
Stable Platform	Whittaker	525145	63-5	
Yaw (X) Axis				±30
Pitch (Y) Axis				360
Roll (Z) Axis				360

ANGLE OF ATTACK INDICATOR (OGIVE)

Sensor	Manufacturer	Model No.	Serial No.	Range (degrees)
Ogive	Giannini	2519	563	
Yaw (X) Axis				±7.5
Pitch (Y) Axis				±7.5

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TABLE 16 (Continued)

VEHICLE ASPECT SENSORS FOR FLIGHT 17.05 GT-GG

SOLAR SENSOR

Sensor	Manufacturer	Model No.	Serial No.	Range (degrees)
Solar Sensor	Adcole	233C	108	
Eye 1			124	Reticle A = 44.5
Eye 2			122	Reticle B = 57.5
Eye 3			125	

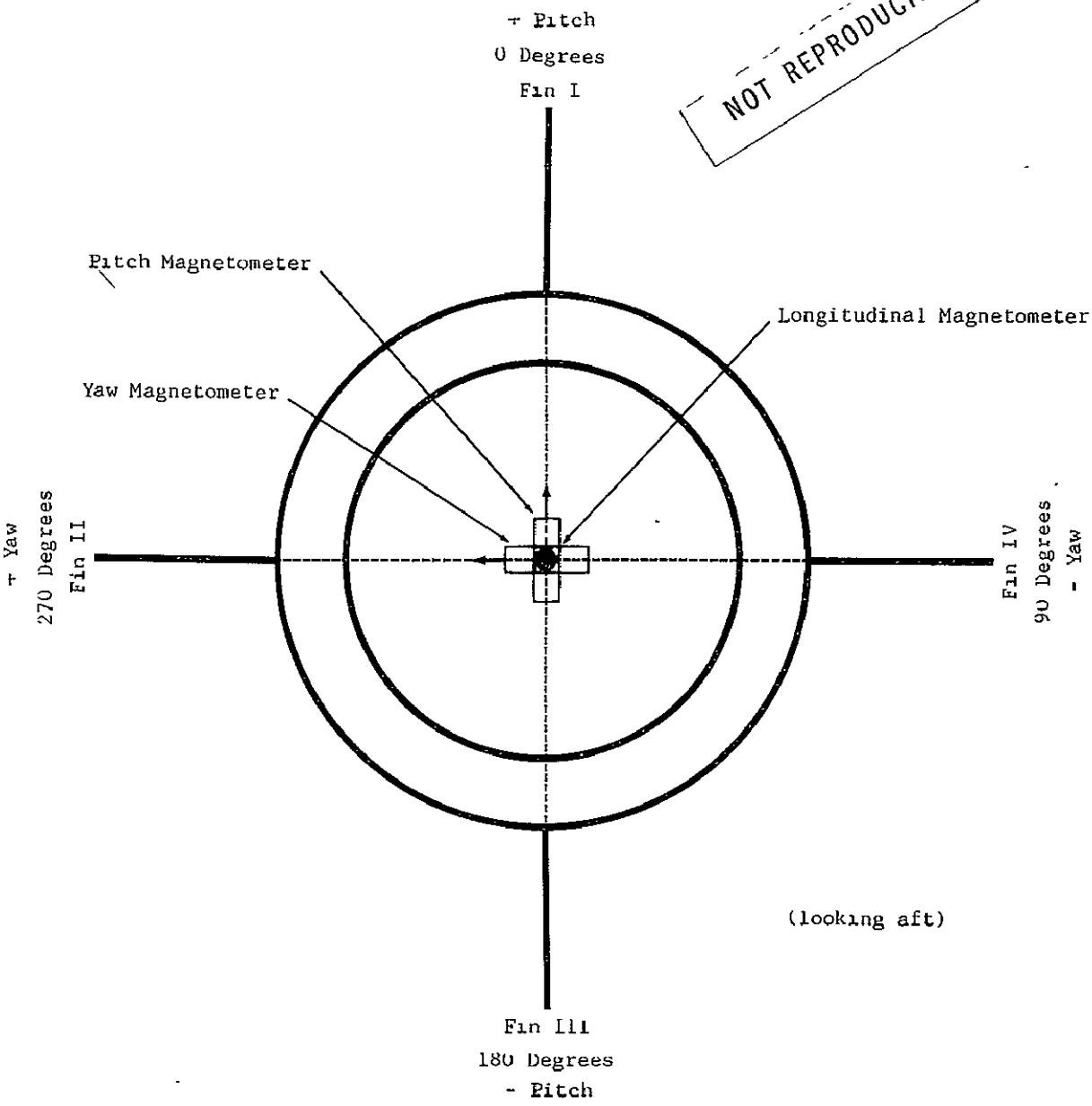
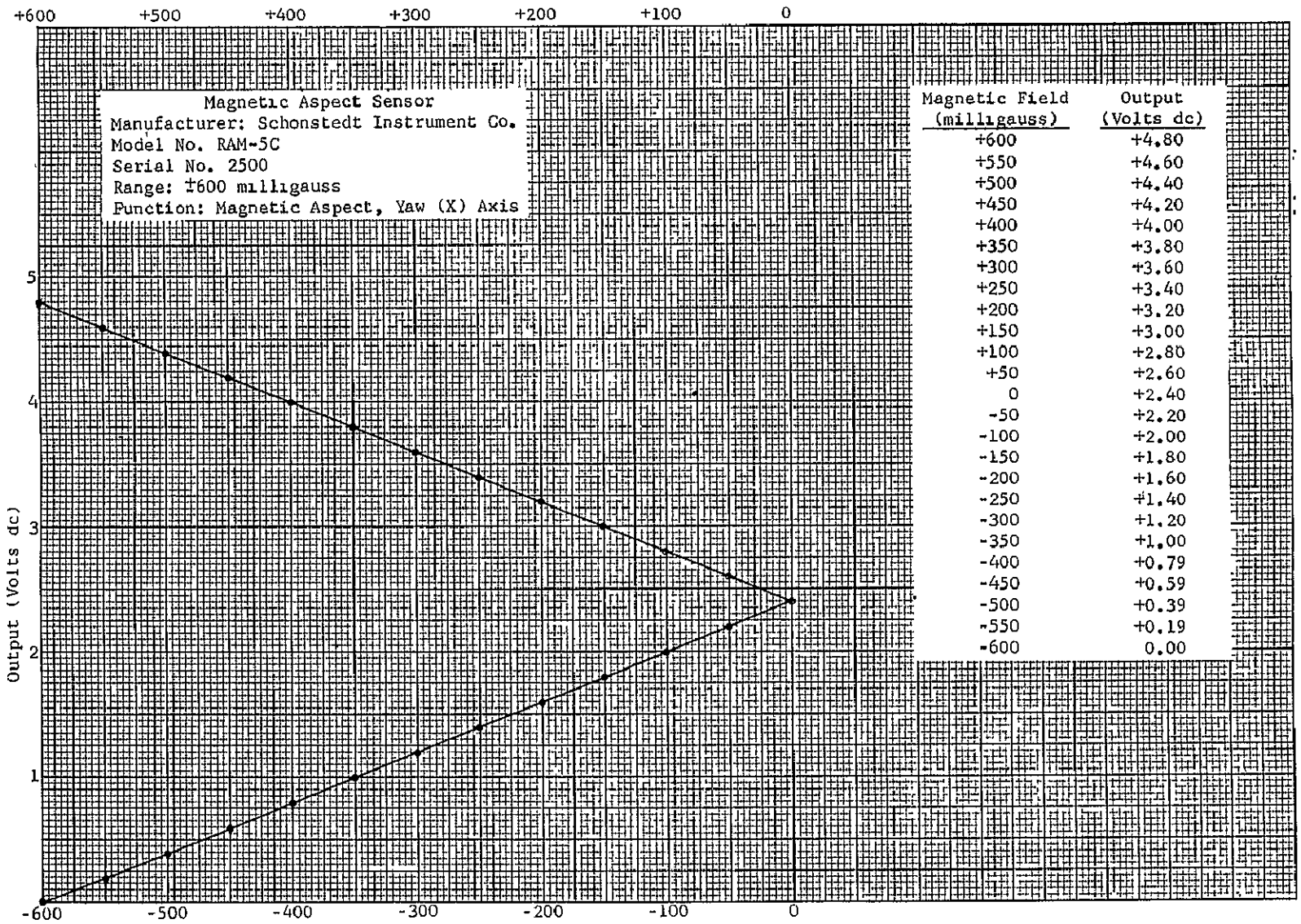
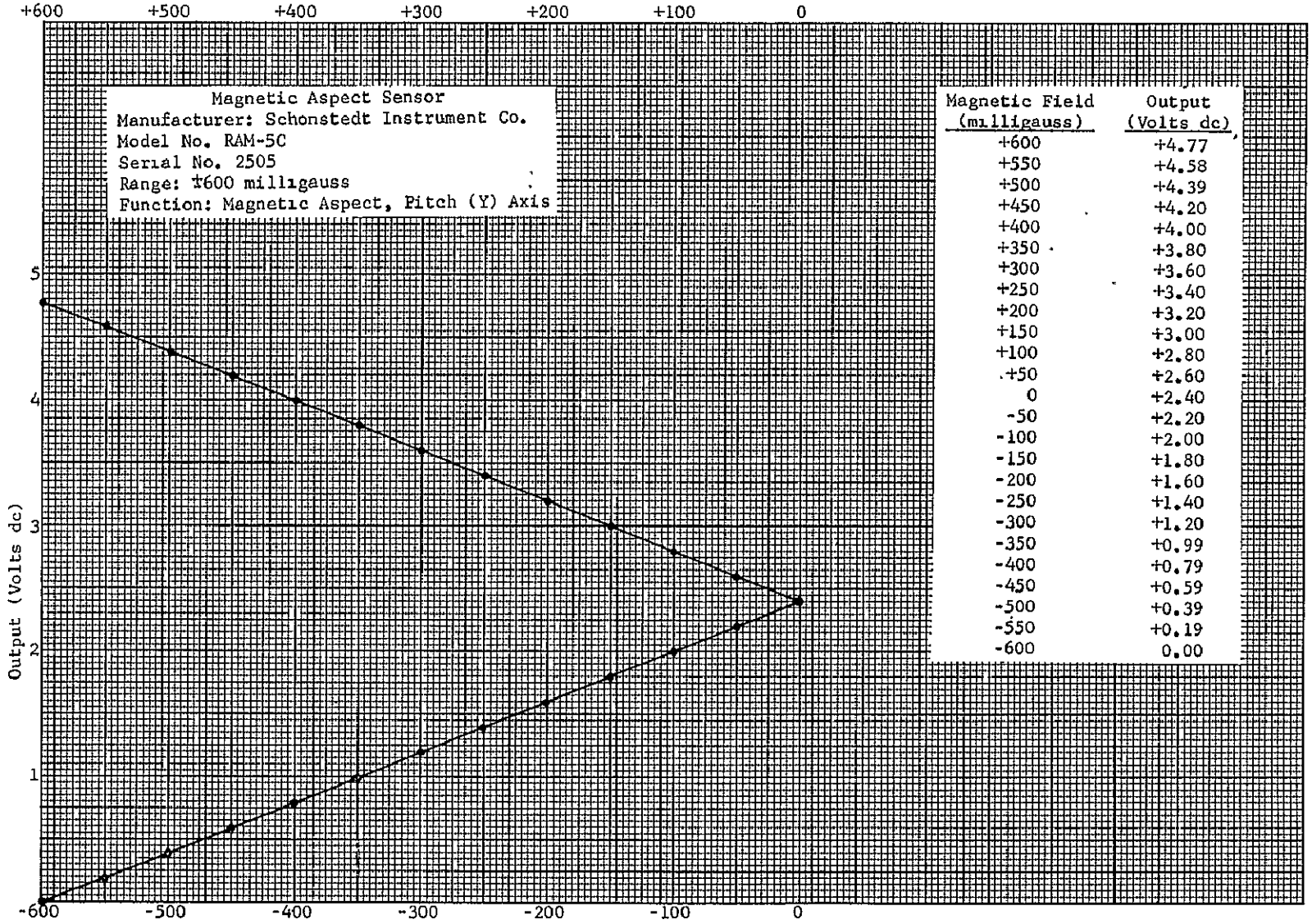


Figure 2. Magnetic Aspect Sensors, Orientation on Flight 17.05GT-GG



Magnetic Field (milligauss)	Output (Volts dc)
+600	+4.80
+550	+4.60
+500	+4.40
+450	+4.20
+400	+4.00
+350	+3.80
+300	+3.60
+250	+3.40
+200	+3.20
+150	+3.00
+100	+2.80
+50	+2.60
0	+2.40
-50	+2.20
-100	+2.00
-150	+1.80
-200	+1.60
-250	+1.40
-300	+1.20
-350	+1.00
-400	+0.79
-450	+0.59
-500	+0.39
-550	+0.19
-600	0.00

Figure 3. Magnetic Aspect Sensor, Calibration for Yaw (X) Axis



Magnetic Field (milligauss)	Output (Volts dc)
+600	+4.77
+550	+4.58
+500	+4.39
+450	+4.20
+400	+4.00
+350	+3.80
+300	+3.60
+250	+3.40
+200	+3.20
+150	+3.00
+100	+2.80
+50	+2.60
0	+2.40
-50	+2.20
-100	+2.00
-150	+1.80
-200	+1.60
-250	+1.40
-300	+1.20
-350	+0.99
-400	+0.79
-450	+0.59
-500	+0.39
-550	+0.19
-600	0.00

Figure 4. Magnetic Aspect Sensor, Calibration for Pitch (Y) Axis

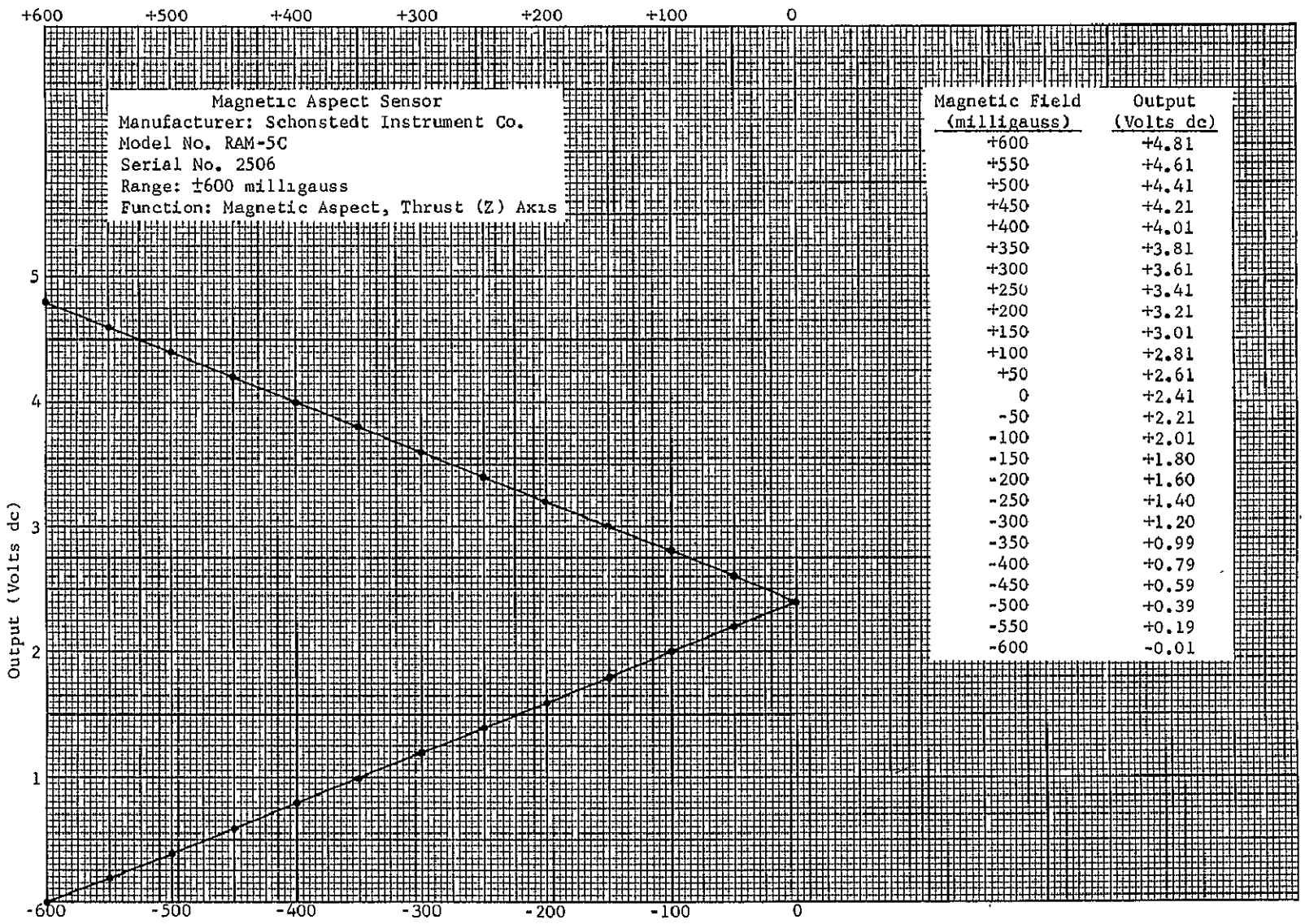


Figure 5. Magnetic Aspect Sensor, Calibration for Thrust (Z) Axis

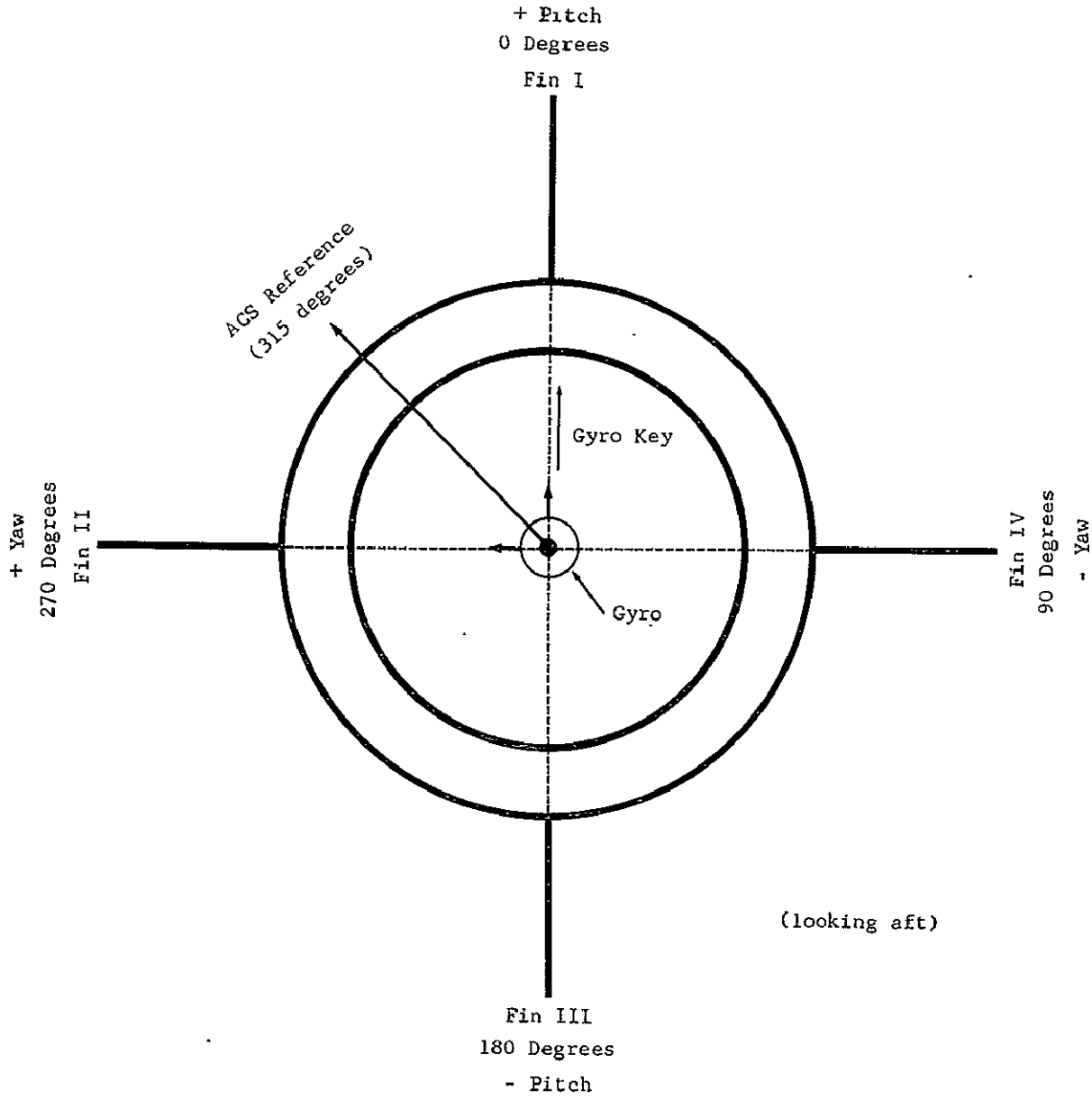


Figure 6. Stable Platform, Orientation on Flight 17.05GT-GG

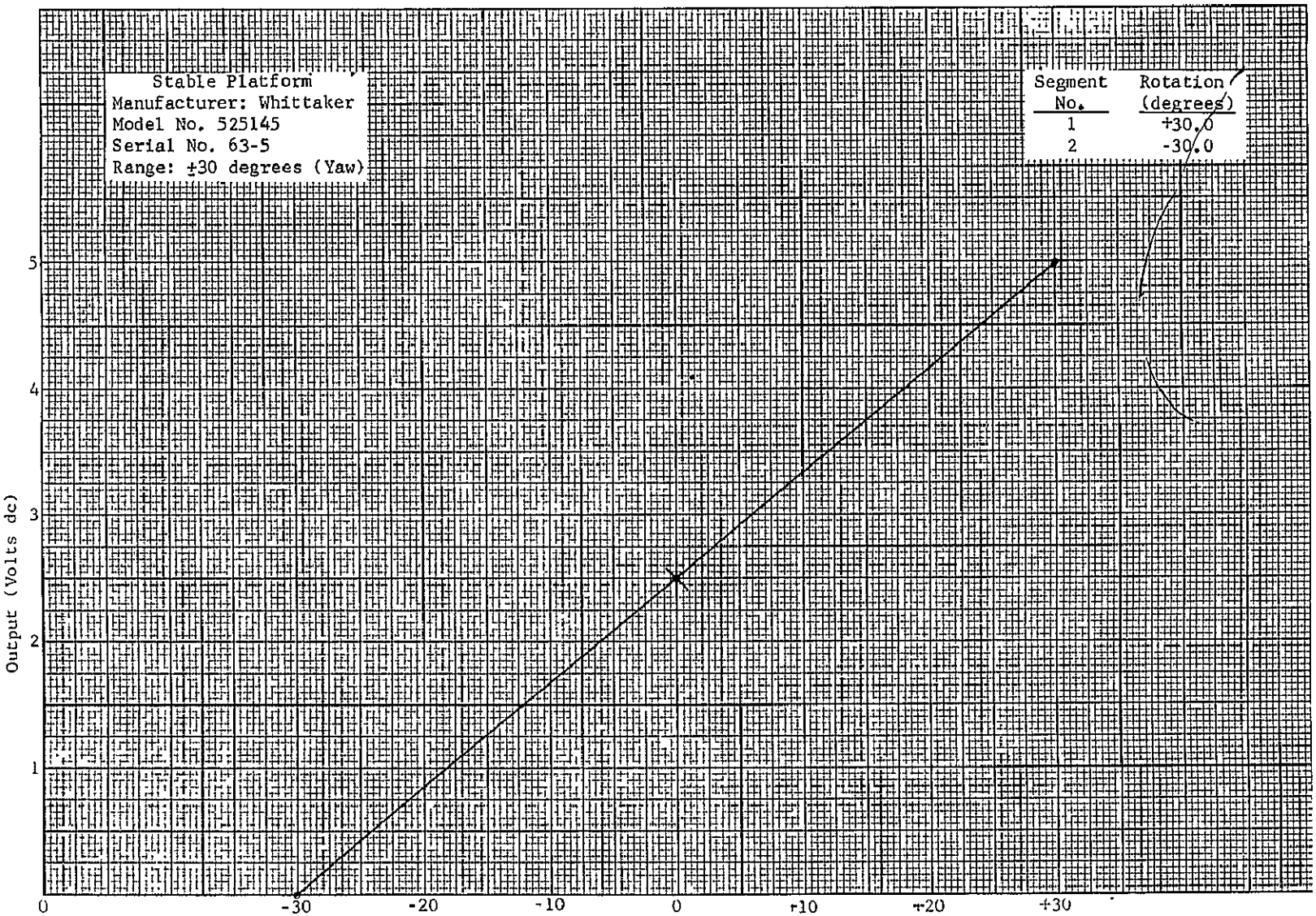


Figure 7. Stable Platform, Calibration for Yaw (X) Axis

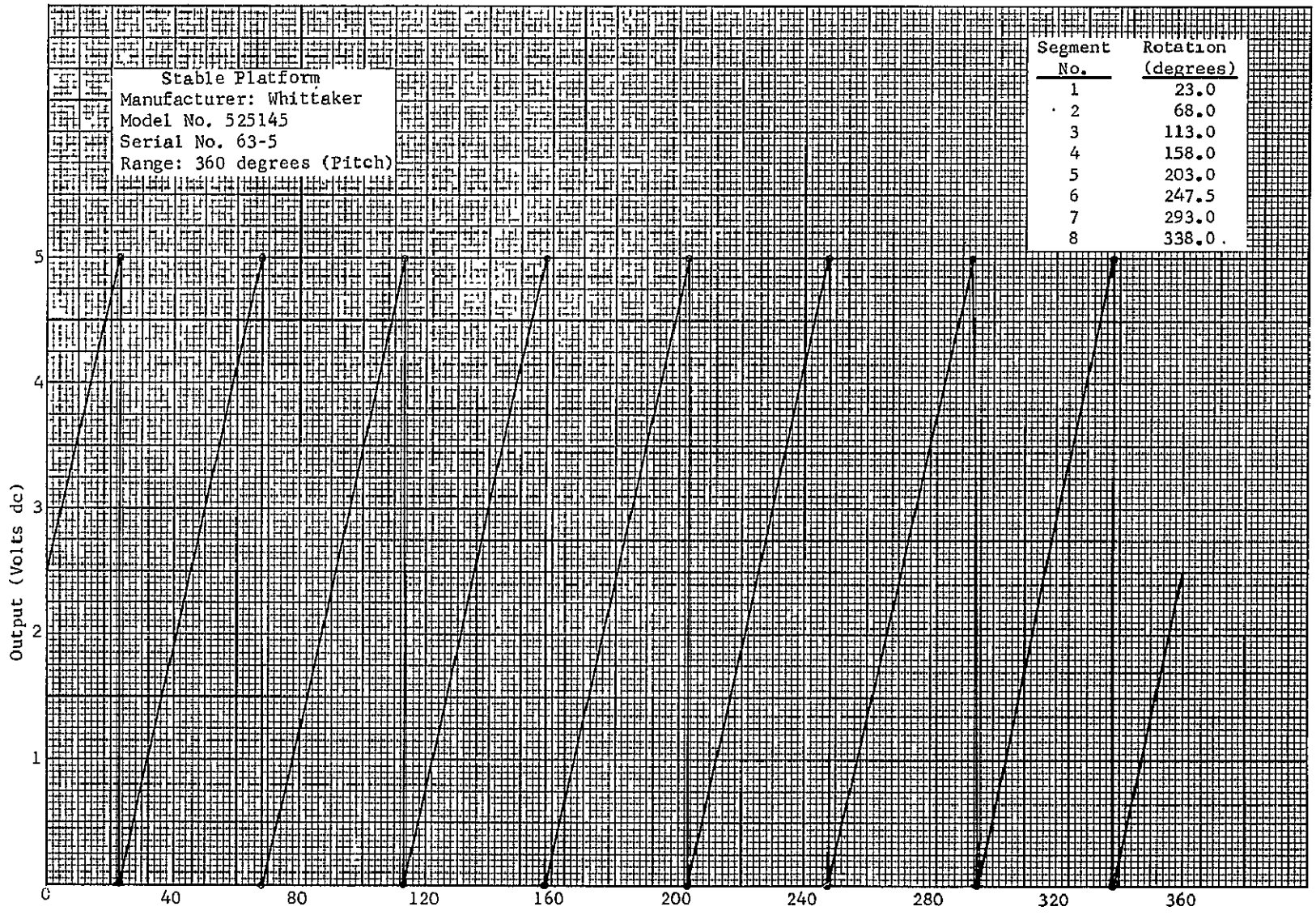


Figure 8. Stable Platform, Calibration for Pitch (Y) Axis

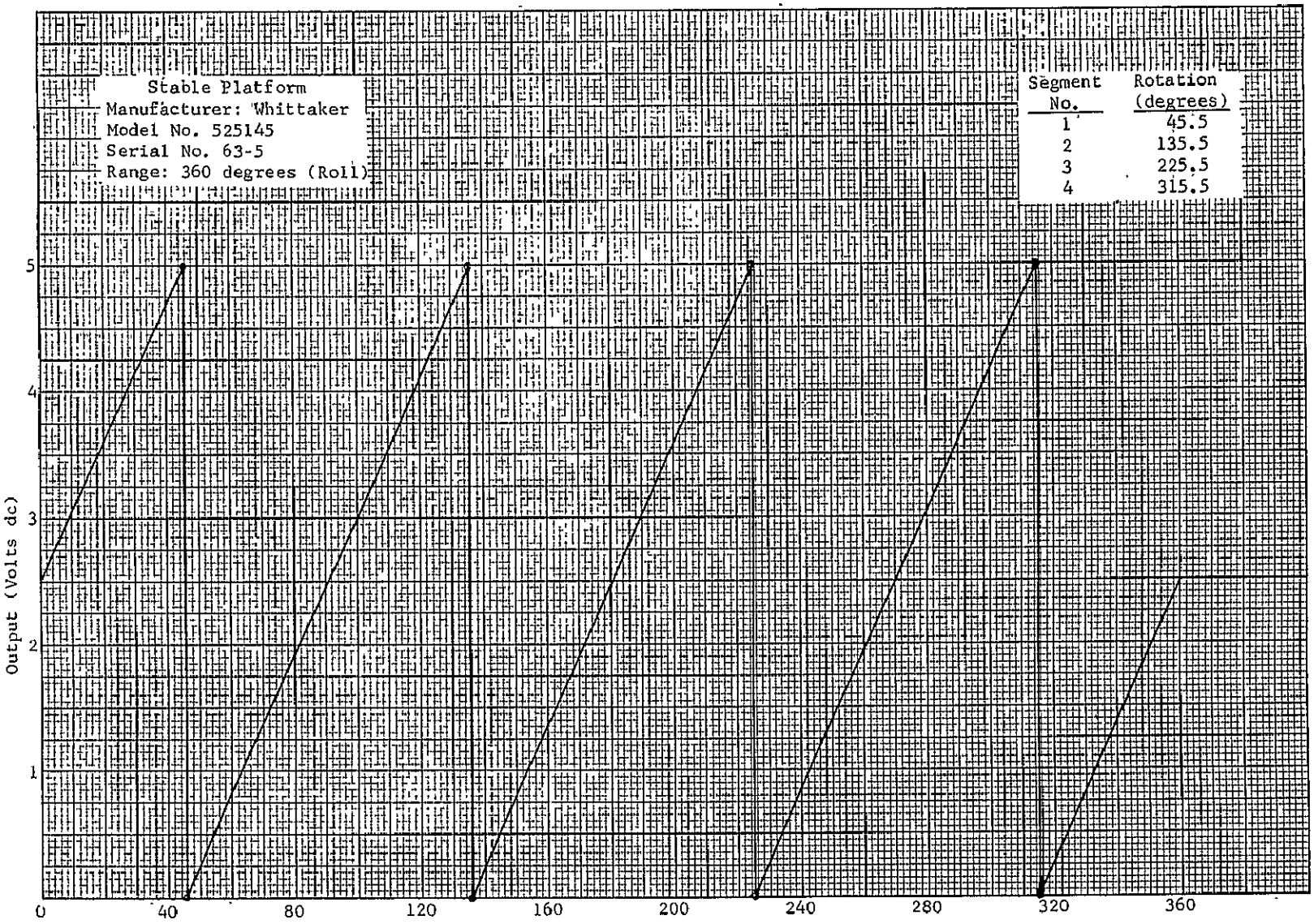
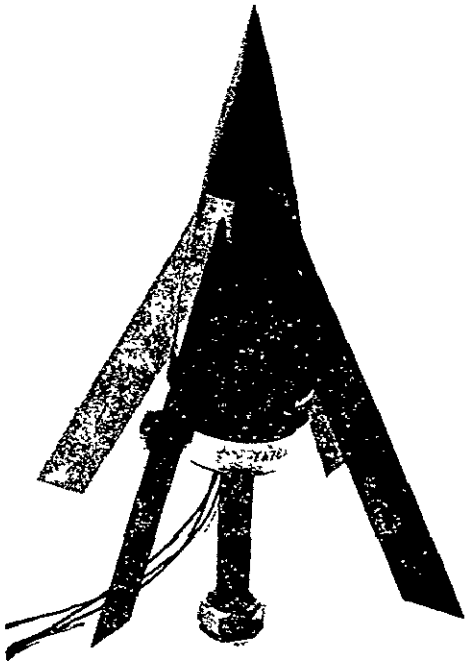
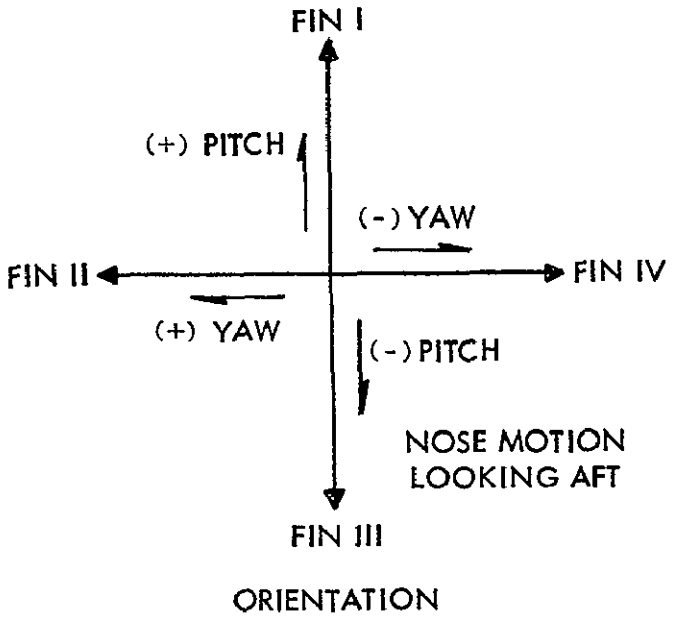


Figure 9. Stable Platform, Calibration for Roll (Z) Axis

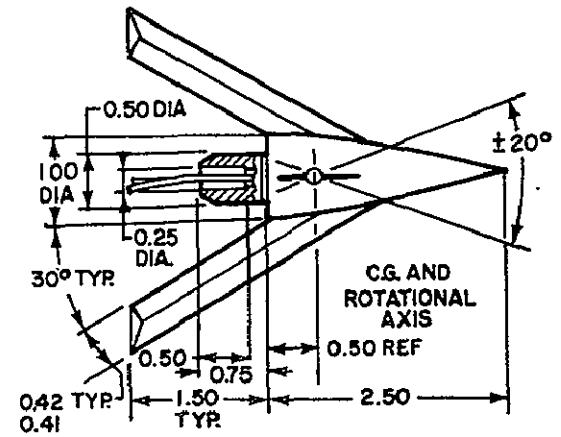


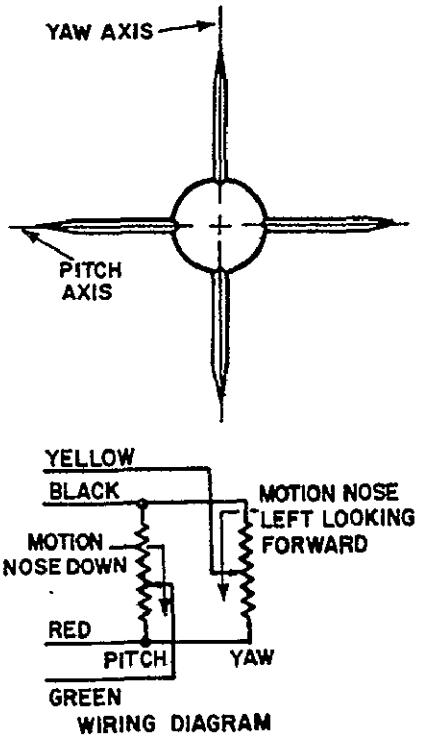
OGIVE INSTRUMENT



ORIENTATION

DIMENSIONS AND SCHEMATIC DIAGRAM





WIRING DIAGRAM

Figure 10. Angle of Attack Indicator (Ogive), Orientation on Flight 17.05GT-GG

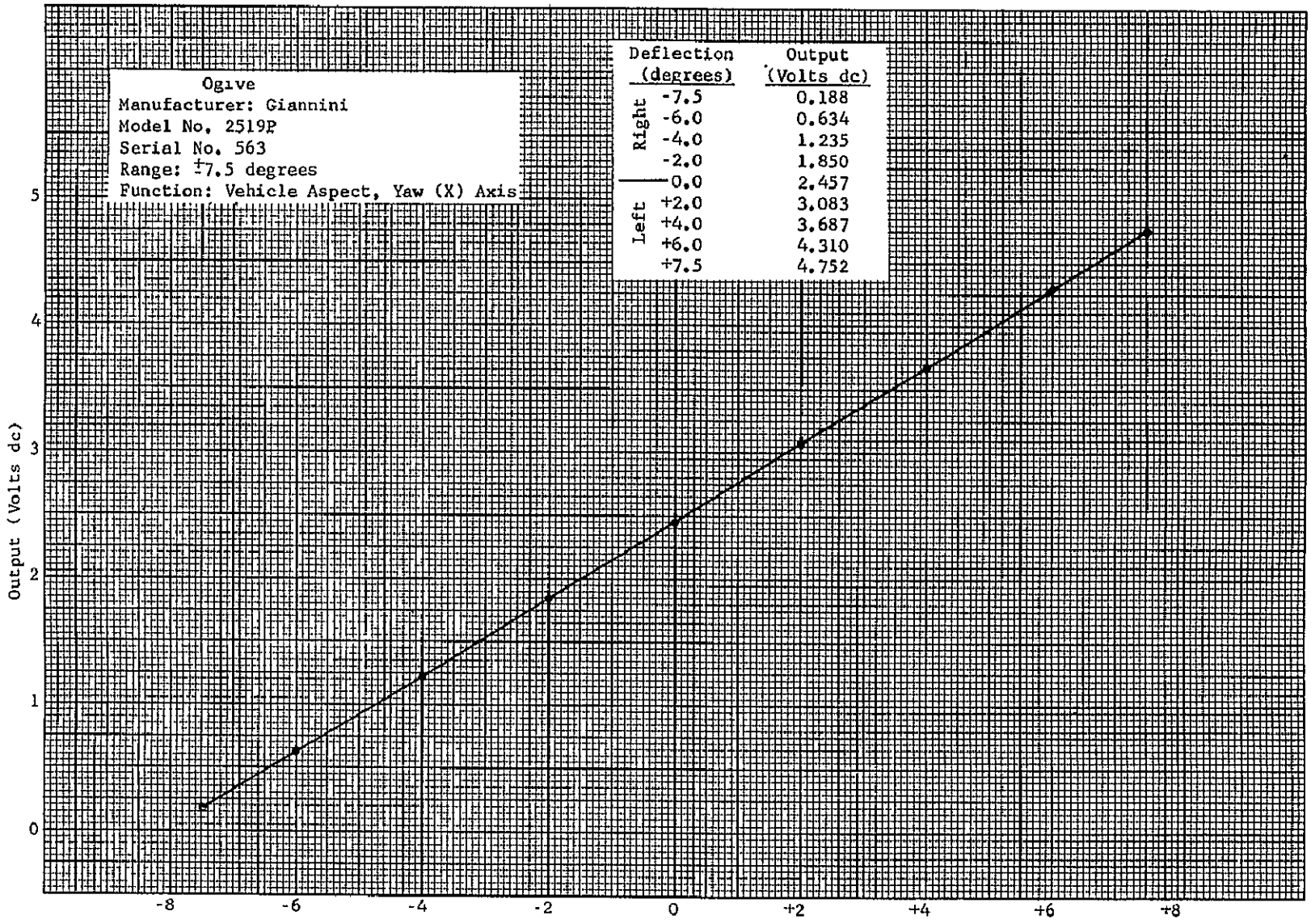


Figure 11. Angle of Attack Indicator (Ogive), Calibration for Yaw (X) Axis

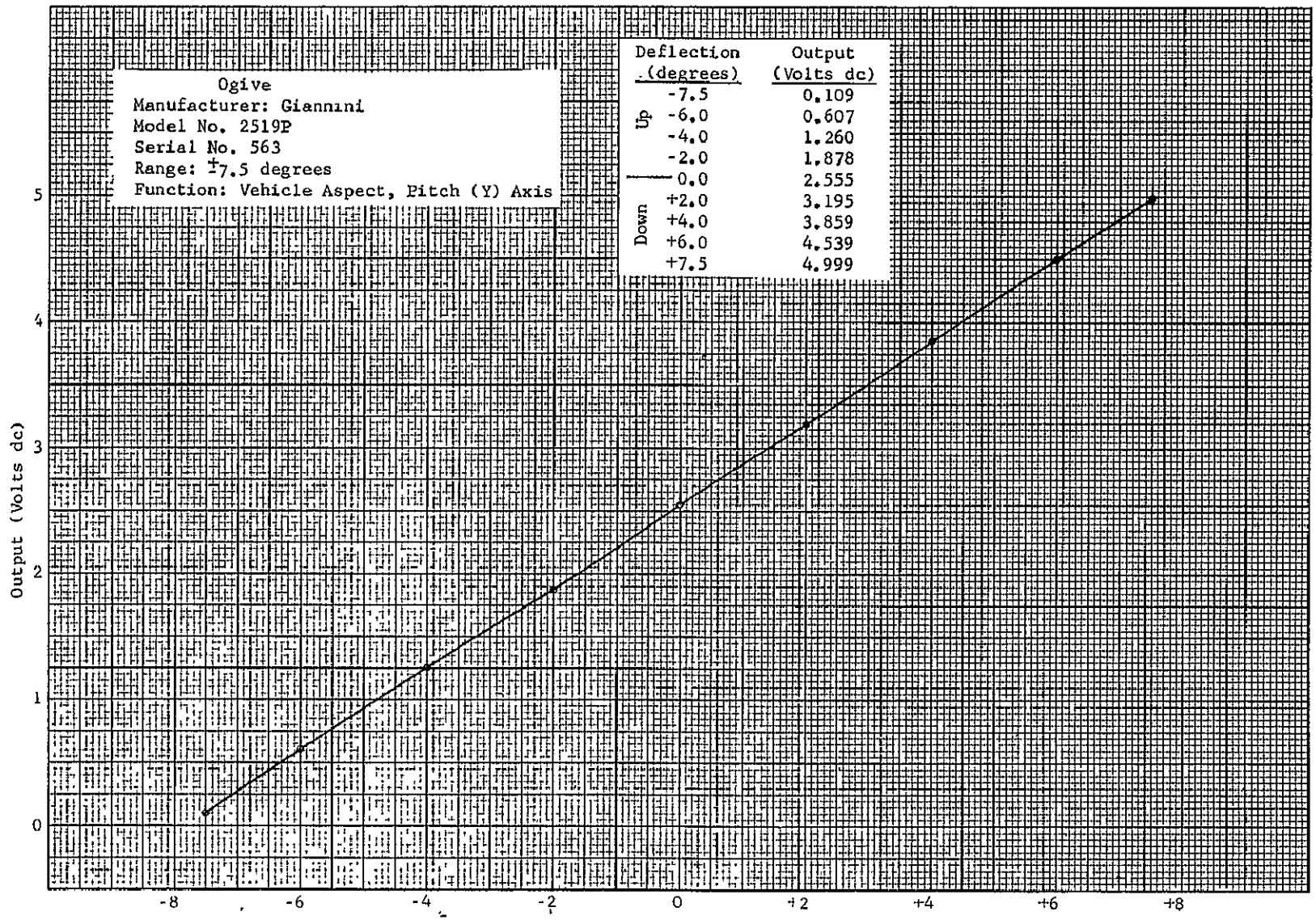


Figure 12. Angle of Attack Indicator (Ogive), Calibration for Pitch (Y) Axis

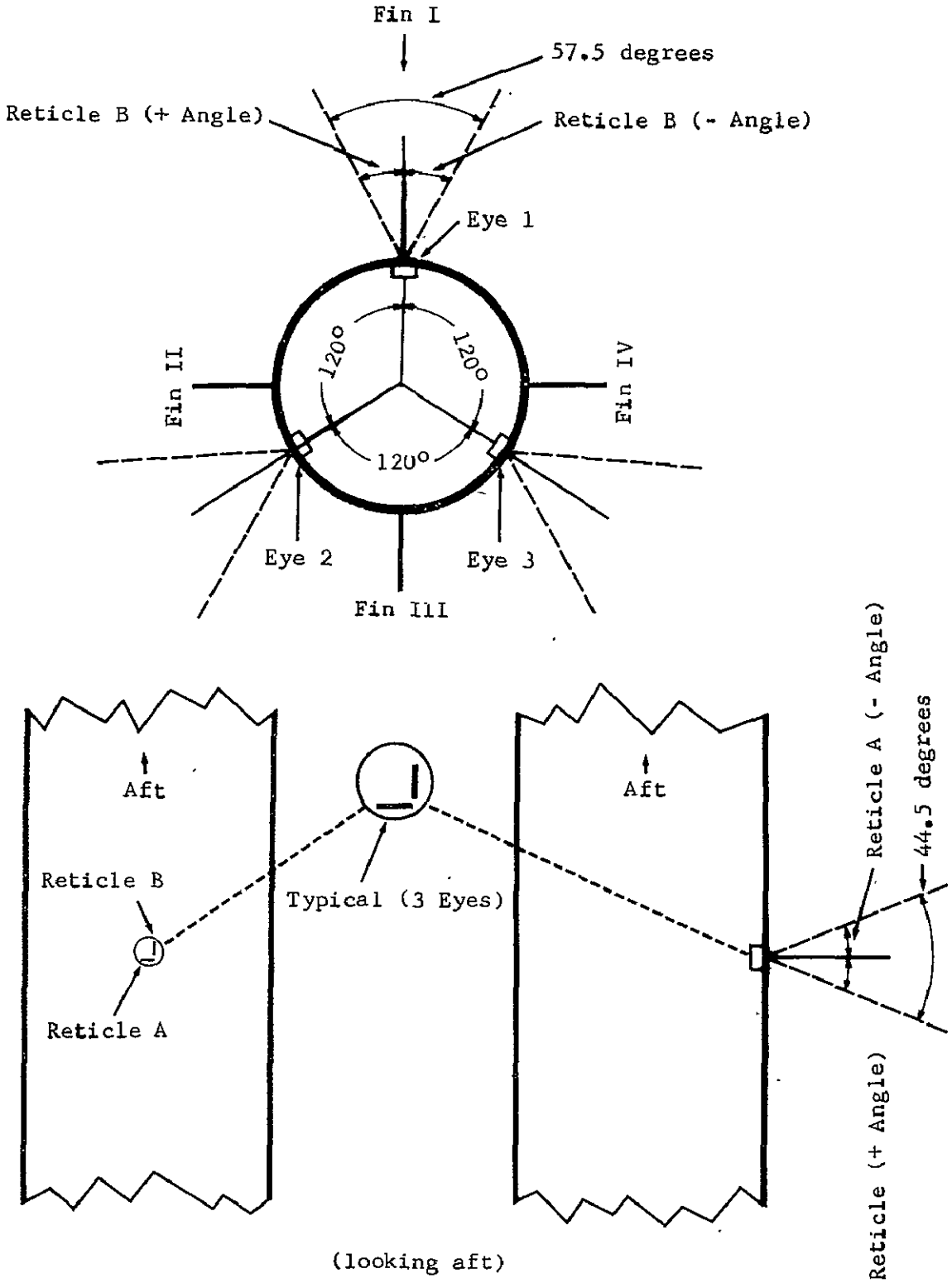


Figure 13. Solar Aspect Sensors, Orientation on Flight 17.05 GT-GG

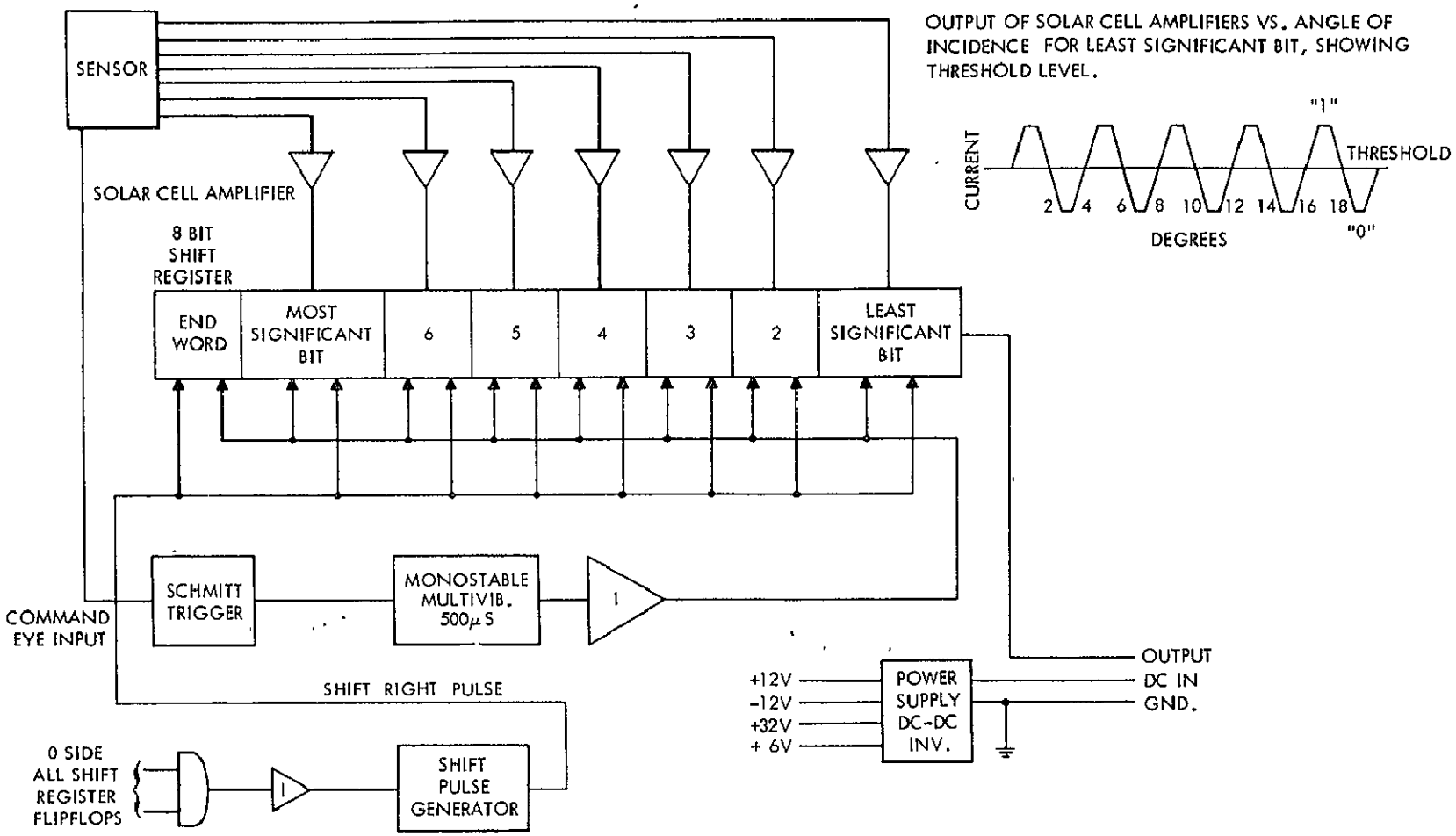
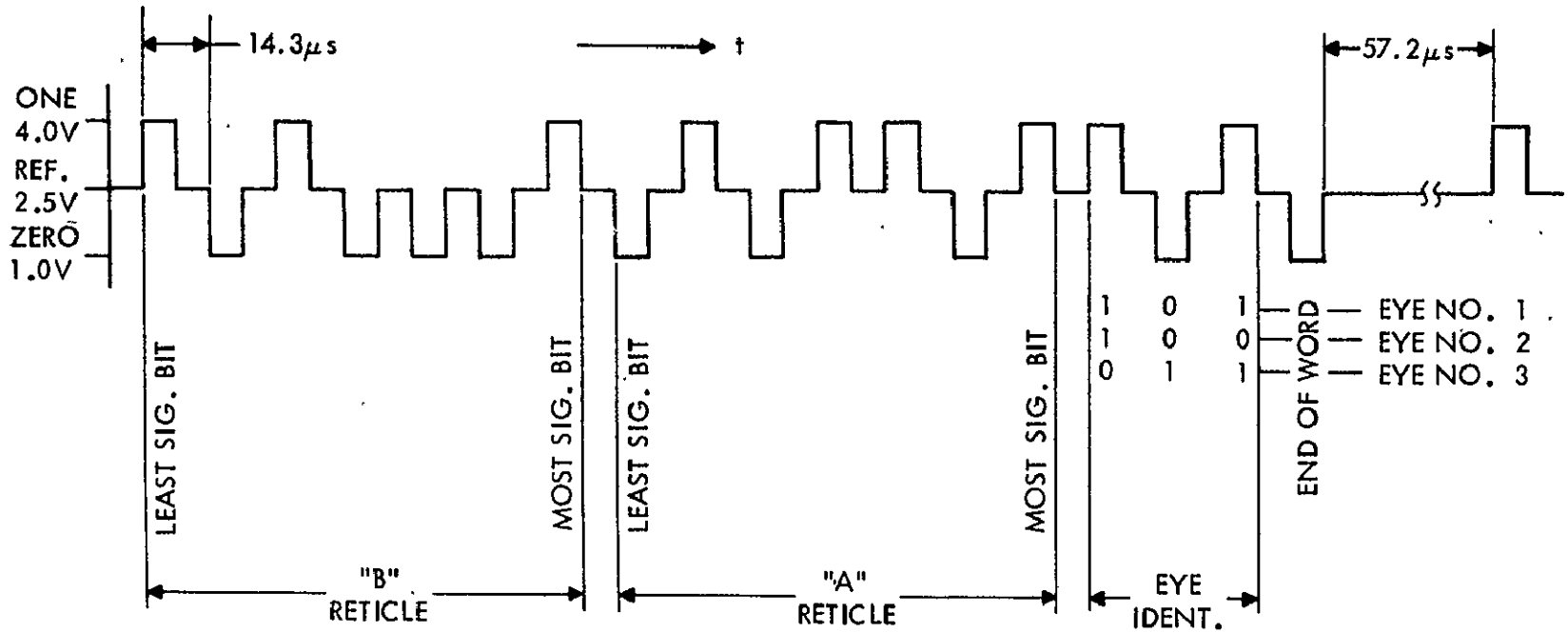


Figure 14. Solar Aspect System, Block Diagram



ABOVE READING

EYE NO. 1
- "A" RETICLE = 1011010 = -44.5 DEGREES (MOST / LEAST)
- "B" RETICLE = 1000101 = -57.5 DEGREES

Figure 15. Solar Aspect System, Data Train

TABLE 17

SOLAR ASPECT SENSOR (MODEL 135) CODE TABLE

ANGLE	GRAY CODE	ANGLE	GRAY CODE
-63.5	0000000	-30.5	0110001
-62.5	0000001	-29.5	0110011
-61.5	0000011	-28.5	0110010
-60.5	0000010	-27.5	0110110
-59.5	0000110	-26.5	0110111
-58.5	0000111	-25.5	0110101
-57.5	0000101	-24.5	0110100
-56.5	0000100	-23.5	0111100
-55.5	0001100	-22.5	0111101
-54.5	0001101	-21.5	0111111
-53.5	0001111	-20.5	0111110
-52.5	0001110	-19.5	0111010
-51.5	0001010	-18.5	0111011
-50.5	0001011	-17.5	0111001
-49.5	0001001	-16.5	0111000
-48.5	0001000	-15.5	0101000
-47.5	0011000	-14.5	0101001
-46.5	0011001	-13.5	0101011
-45.5	0011011	-12.5	0101010
-44.5	0011010	-11.5	0101110
-43.5	0011110	-10.5	0101111
-42.5	0011111	- 9.5	0101101
-41.5	0011101	- 8.5	0101100
-40.5	0011100	- 7.5	0100100
-39.5	0010100	- 6.5	0100101
-38.5	0010101	- 5.5	0100111
-37.5	0010111	- 4.5	0100110
-36.5	0010110	- 3.5	0100010
-35.5	0010010	- 2.5	0100011
-34.5	0010011	- 1.5	0100001
-33.5	0010001	- 0.5	0100000
-32.5	0010000	+ 0.5	1100000
-31.5	0110000	+ 1.5	1100001
		etc.	

Positive angles same as negative except most significant bit is a 1.

SECTION III

ACCELERATION AND VIBRATION INSTRUMENTATION

TABLE 18

ACCELEROMETERS (INCLUDING VIBRATION)
USED FOR FLIGHT 17.05 GT-GG

ACCELERATION SENSORS

Sensor	Manufacturer	Model No.	Serial No.	Range (g)
Accelerometer: Yaw (X) Axis Amplifier	 CEC BLH	 4-202-0001 950	 8340 061	 ±25
Accelerometer: Pitch (Y) Axis Amplifier	 CEC BLH	 4-202-0001 950	 7105 065	 ±25
Accelerometer: Thrust (Z) Axis Amplifier	 CEC BLH	 4-202-0001 950	 8339 032	 ±25
Accelerometer: Thrust (Z_2) Axis	 Conrac	 24155F	 143-2	 -1 to +15

VIBRATION SENSORS

Sensor	Manufacturer	Model No.	Serial No.	Range (g)
Accelerometer: Yaw (X) Axis Amplifier	 Endevco Endevco	 2221E 2641M5	 PA17 LA27	 ±50
Accelerometer: Pitch (Y) Axis Amplifier	 Endevco Endevco	 2221E 2641M5	 PB68 LA28	 ±50
Accelerometer: Thrust (Z) Axis Amplifier	 Endevco Endevco	 2221E 2641M5	 PB38 LA24	 ±50
Accelerometer: Yaw (X) Axis Amplifier	 Endevco Endevco	 2221E 2641M5	 PB39 LA20	 ±50

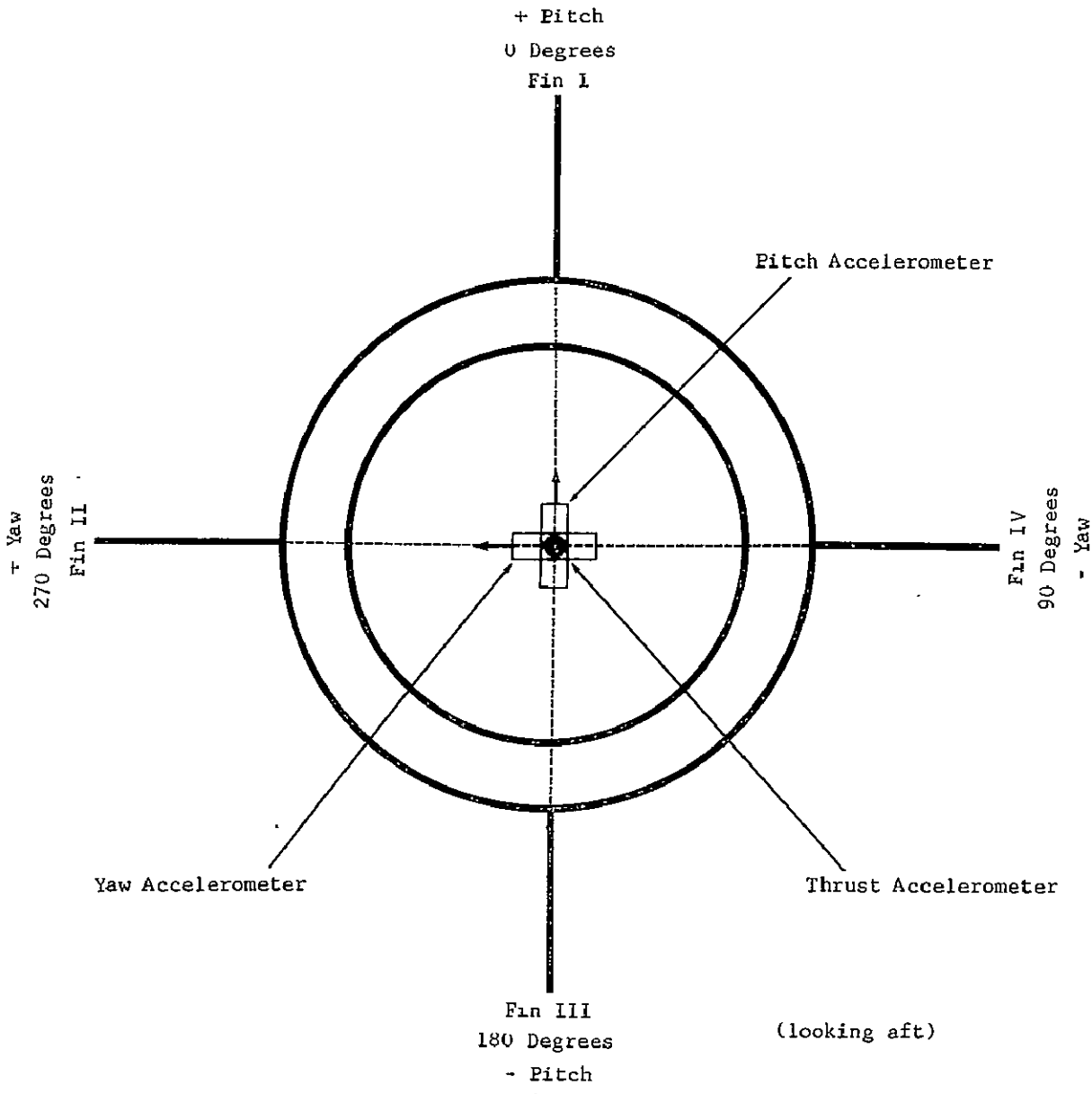


Figure 16. Acceleration Sensors (high frequency), Orientation on Flight 17.05 GT-GG

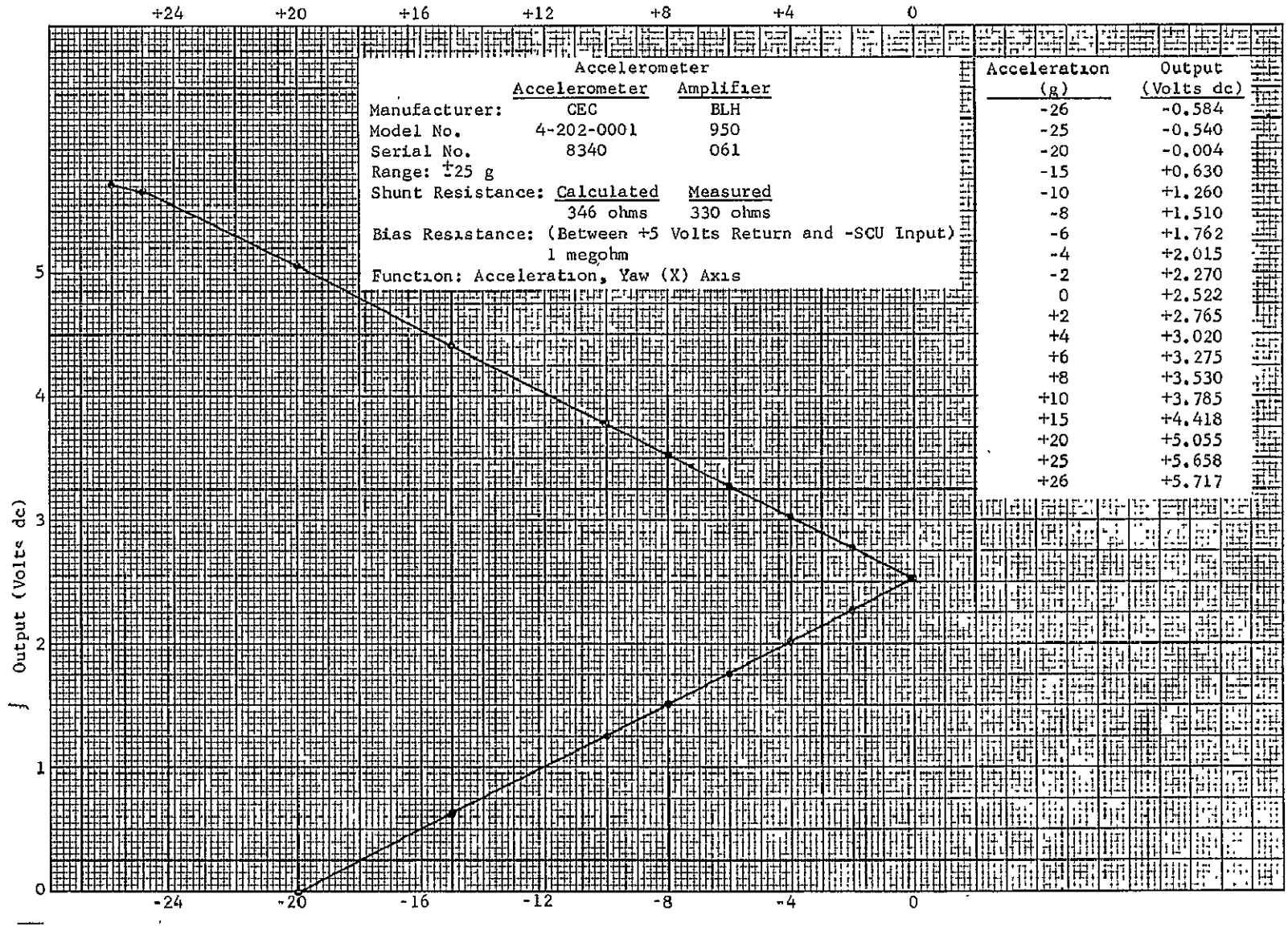


Figure 17. Accelerometer (high frequency), Calibration for Yaw (X) Axis

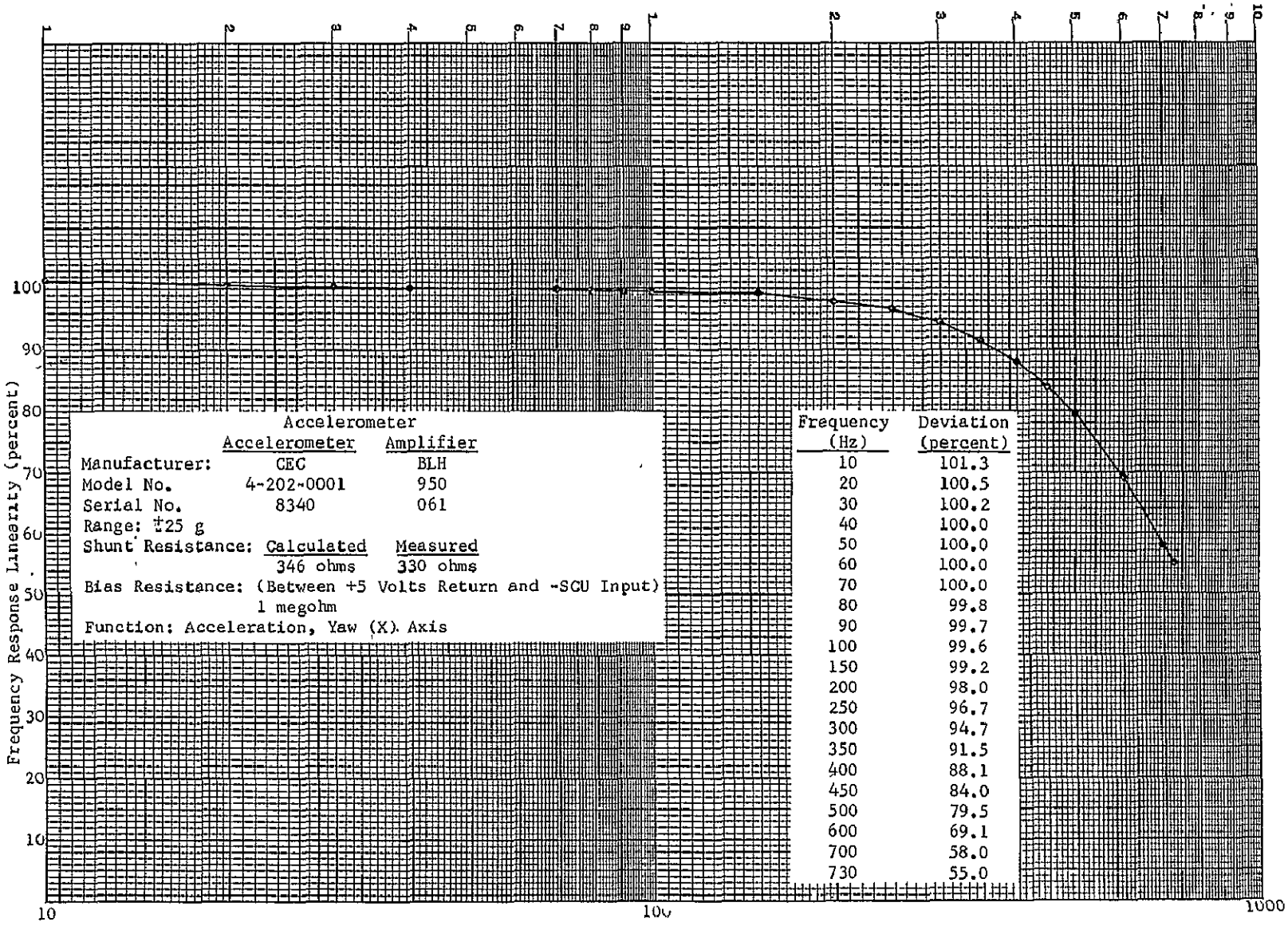


Figure 18. Accelerometer (high frequency), Frequency Response for Yaw (X) Axis

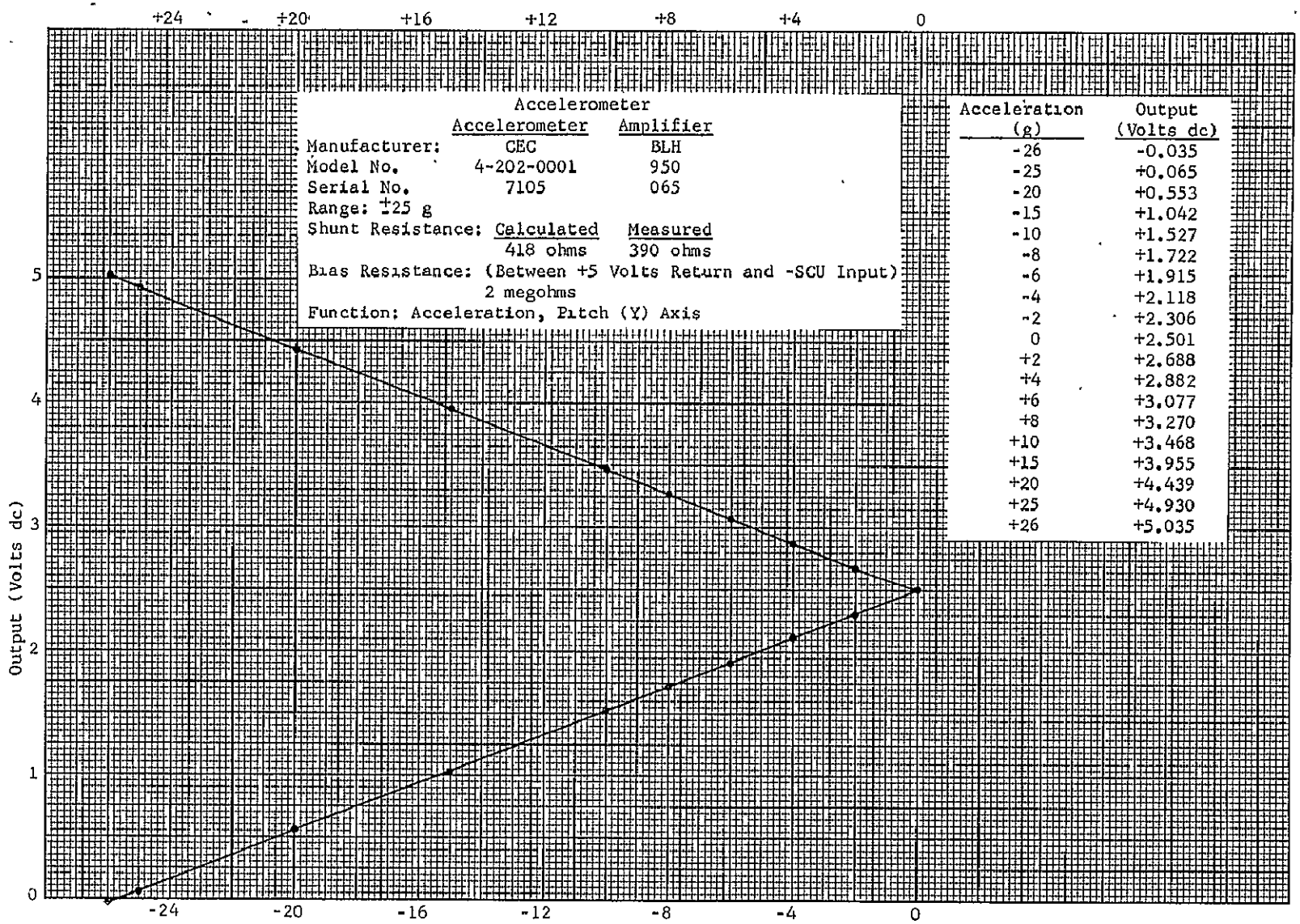


Figure 19. Accelerometer (high frequency), Calibration for Pitch (Y) Axis

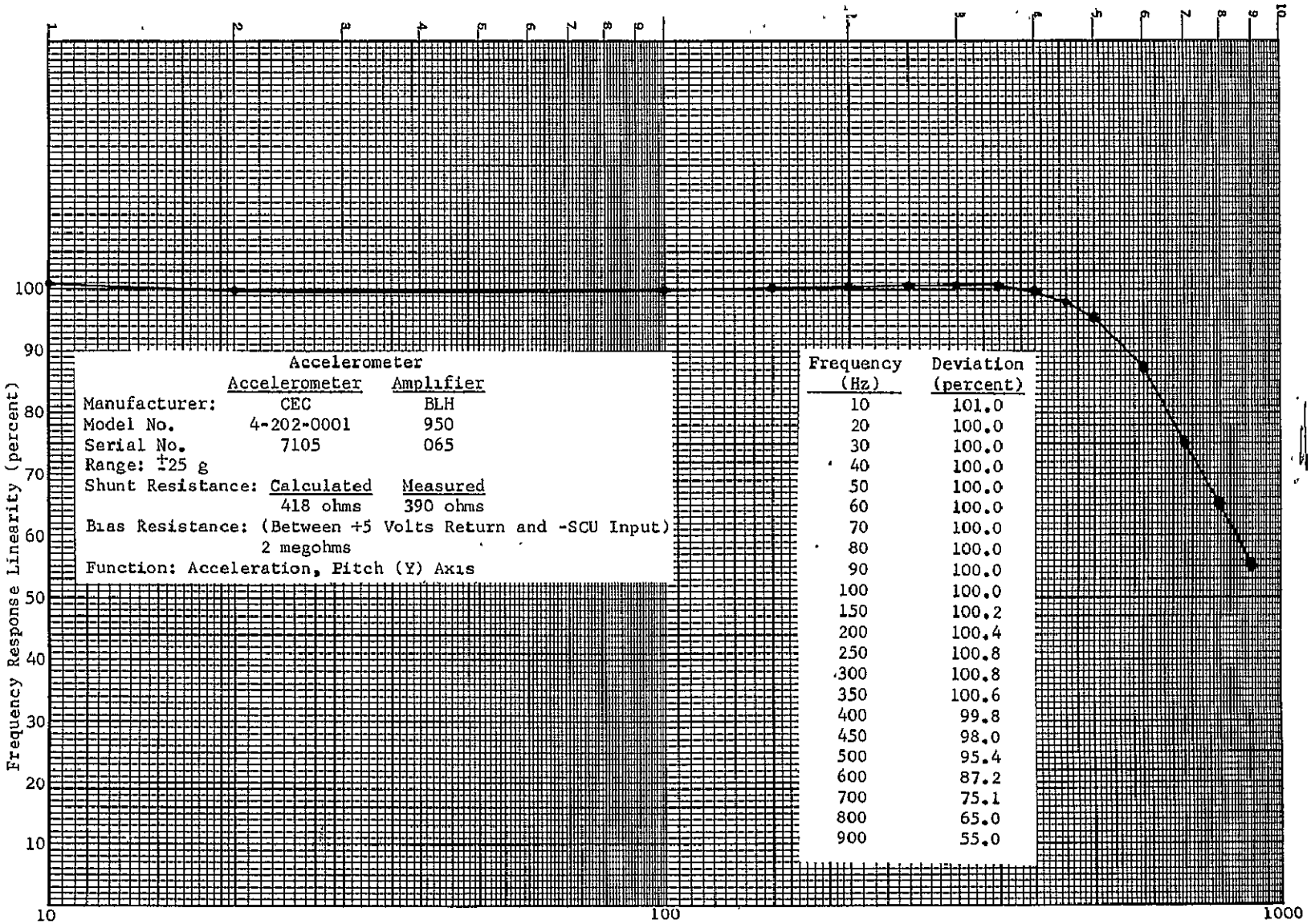


Figure 20. Accelerometer (high frequency), Frequency Response for Pitch (Y) Axis

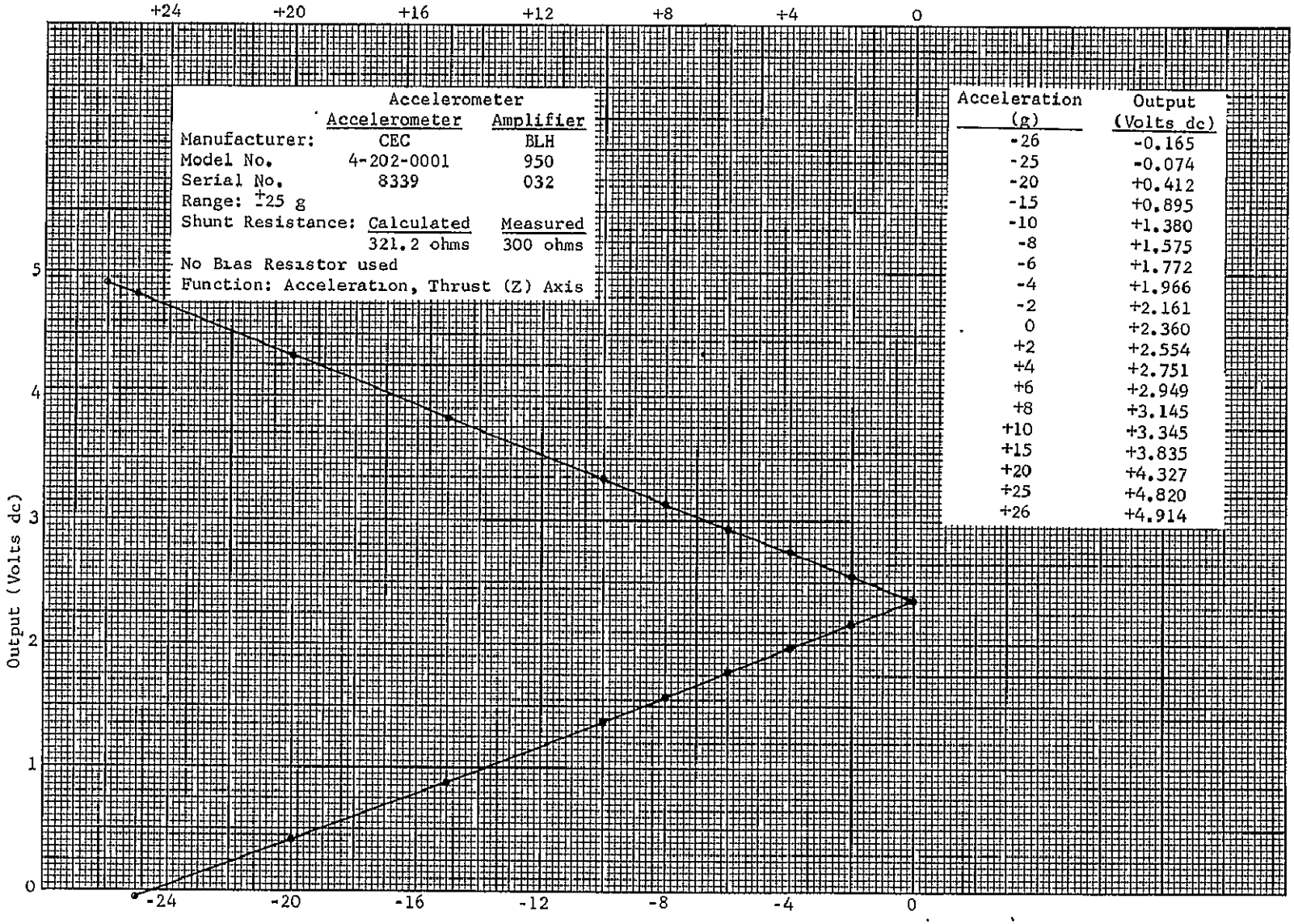


Figure 21. Accelerometer (high frequency), Calibration for Thrust (Z) Axis

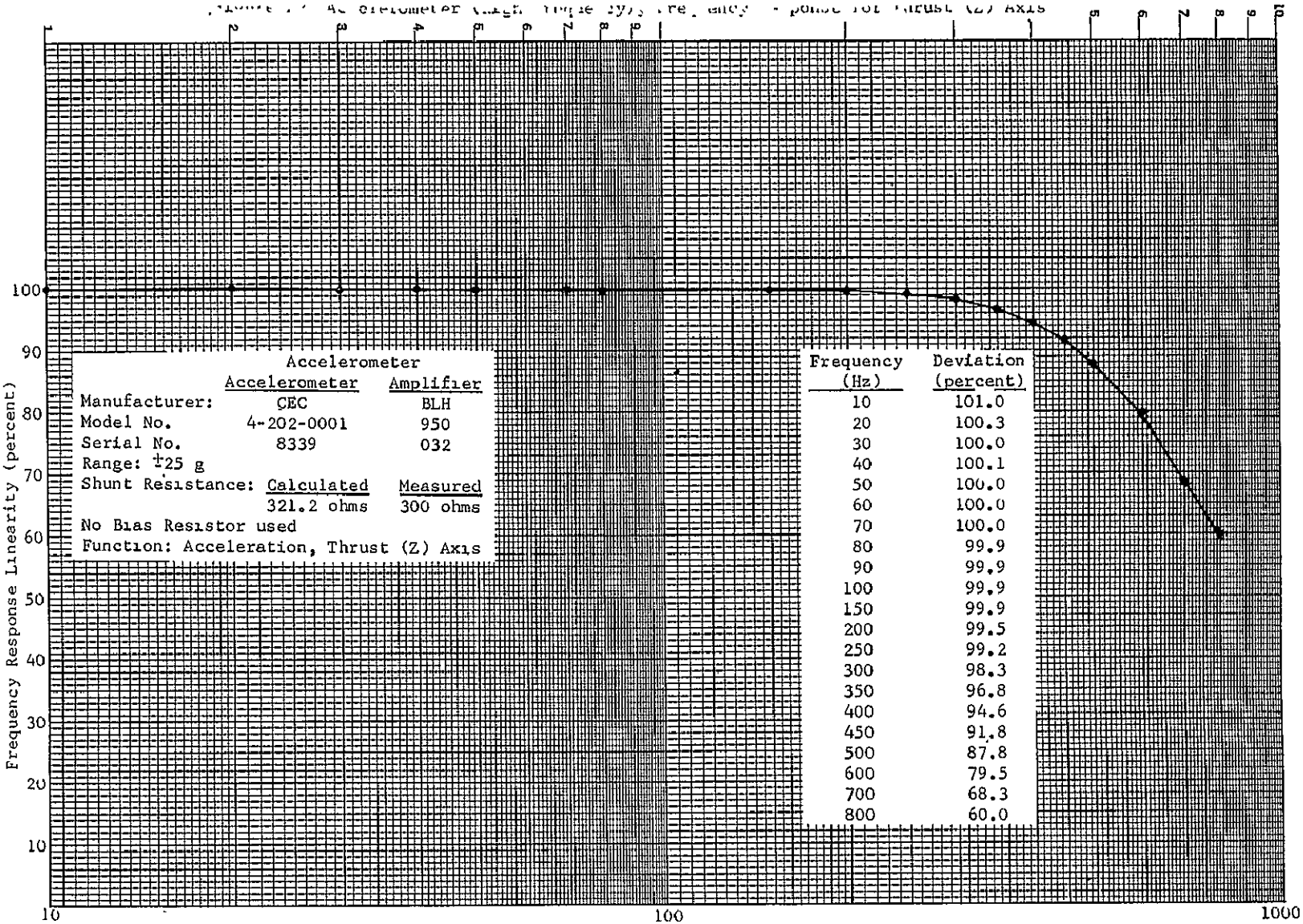


Figure 22. Accelerometer (high frequency), Frequency Response for Thrust (Z) Axis

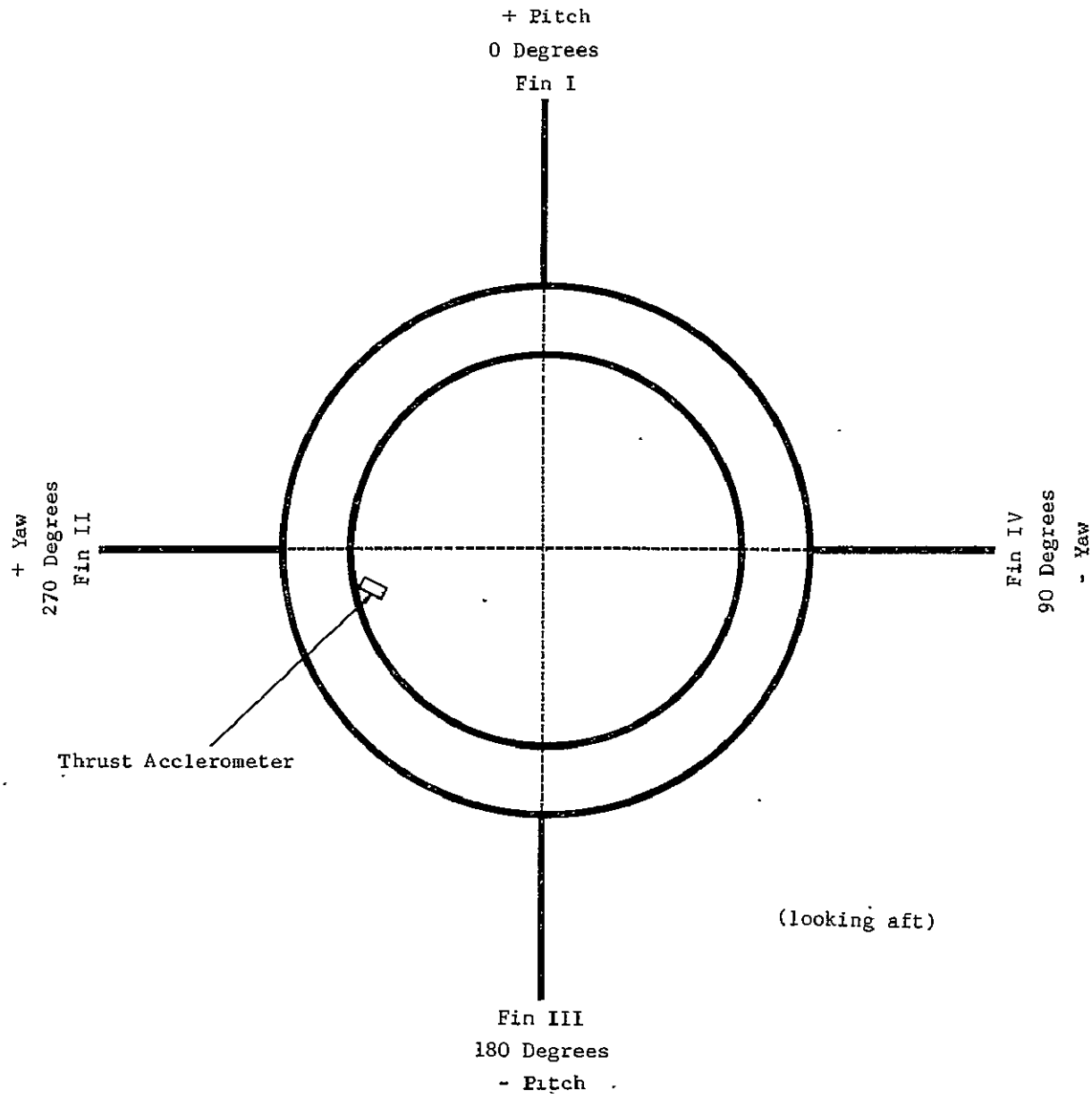


Figure 23. Acceleration Sensor (low frequency), Orientation on Flight 17.05 GT-GG

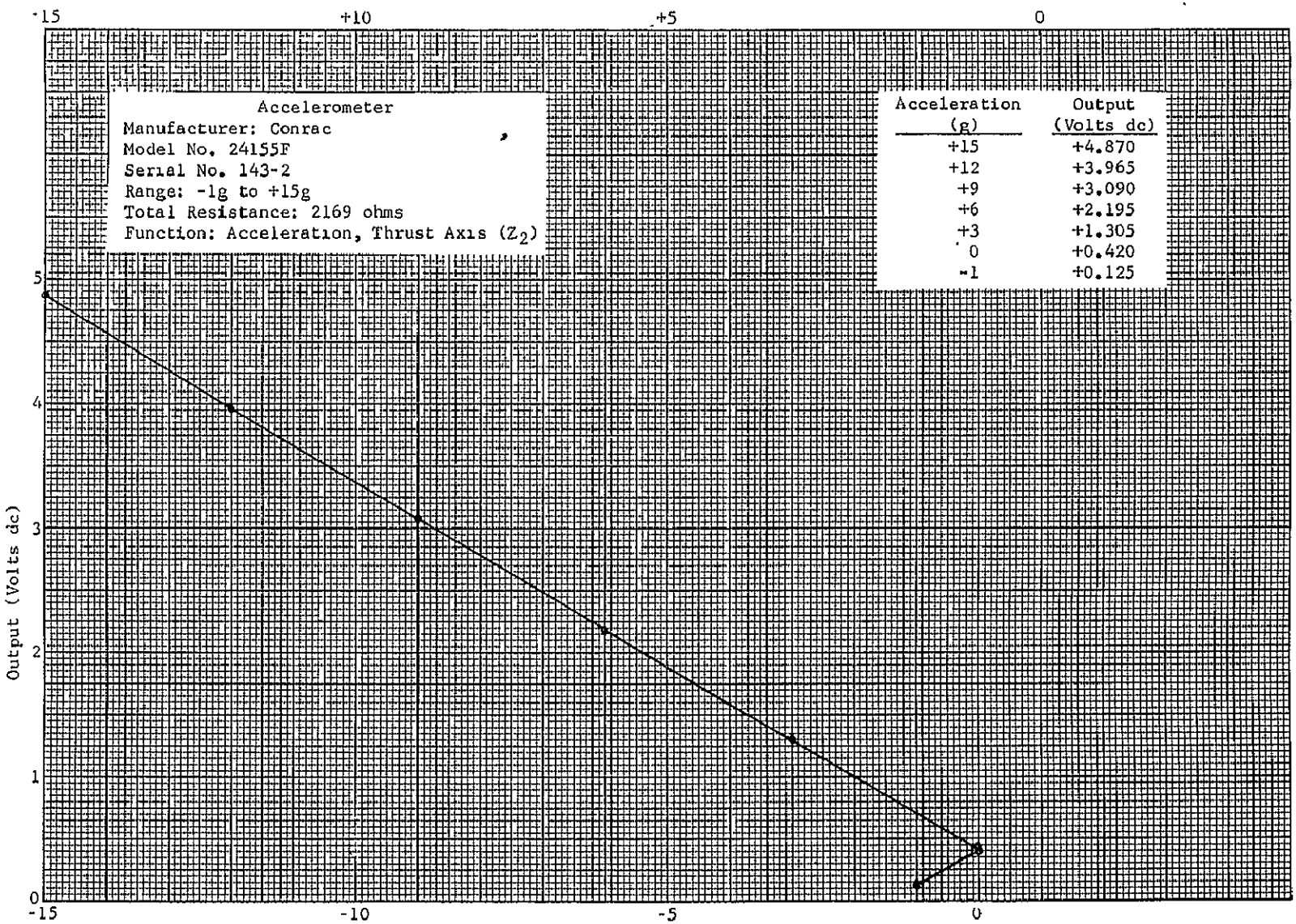


Figure 24. Accelerometer (low frequency), Calibration for Thrust (Z_2) Axis

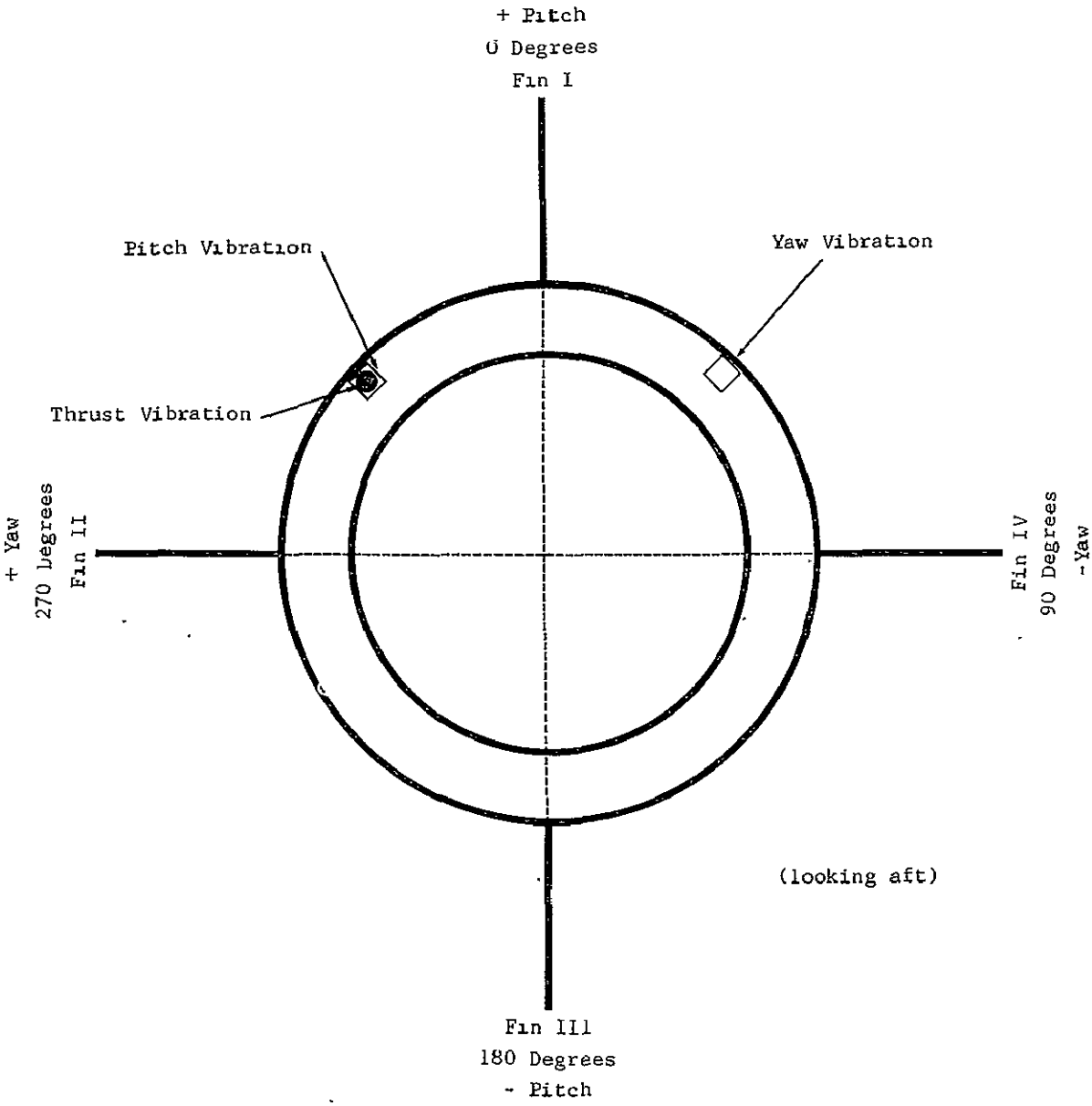


Figure 25. Vibration Acceleration Sensors (Payload), Orientation on Flight 17.05GT-GG

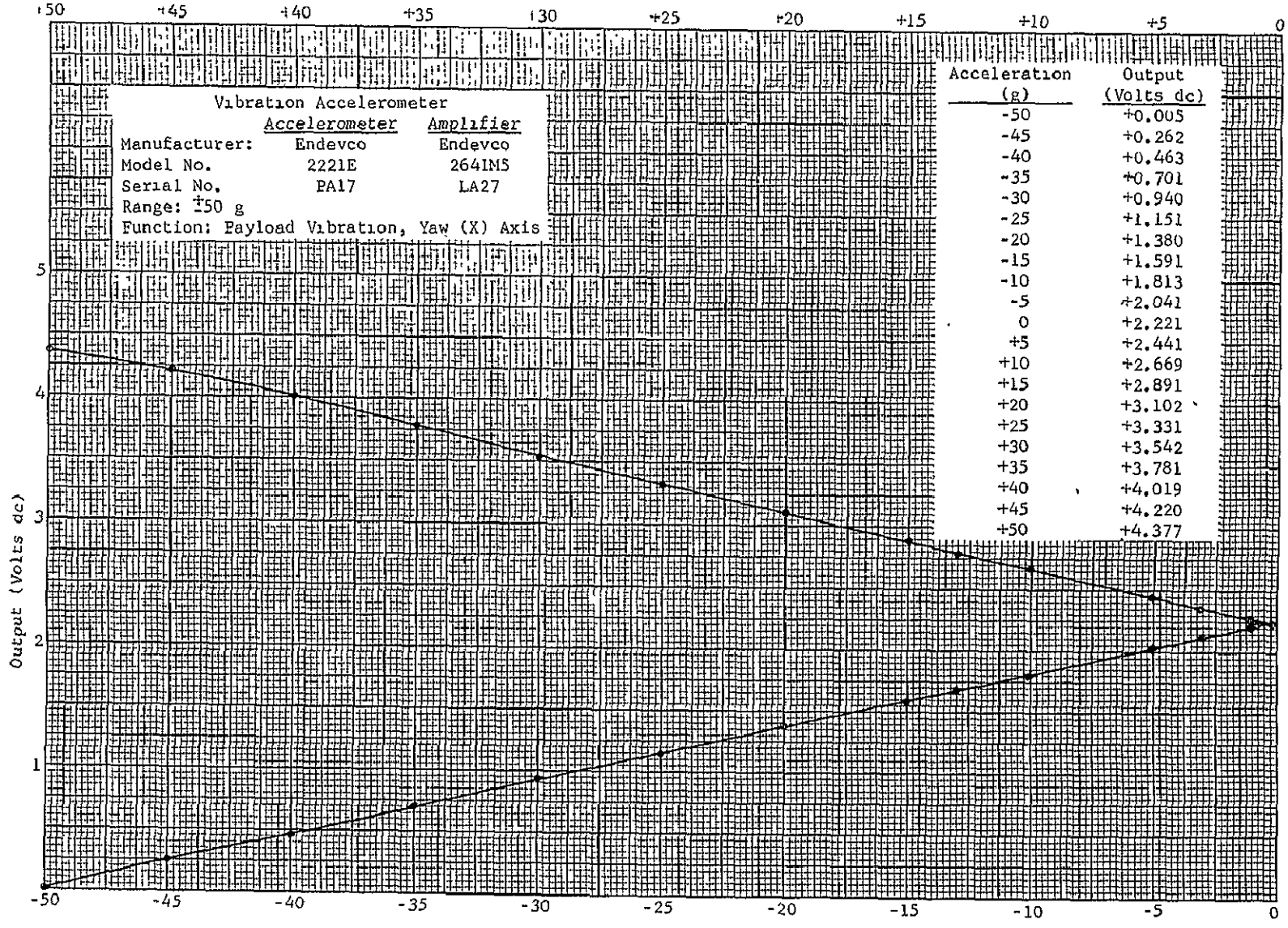


Figure 26. Vibration Accelerometer, Calibration for Yaw (X) Axis

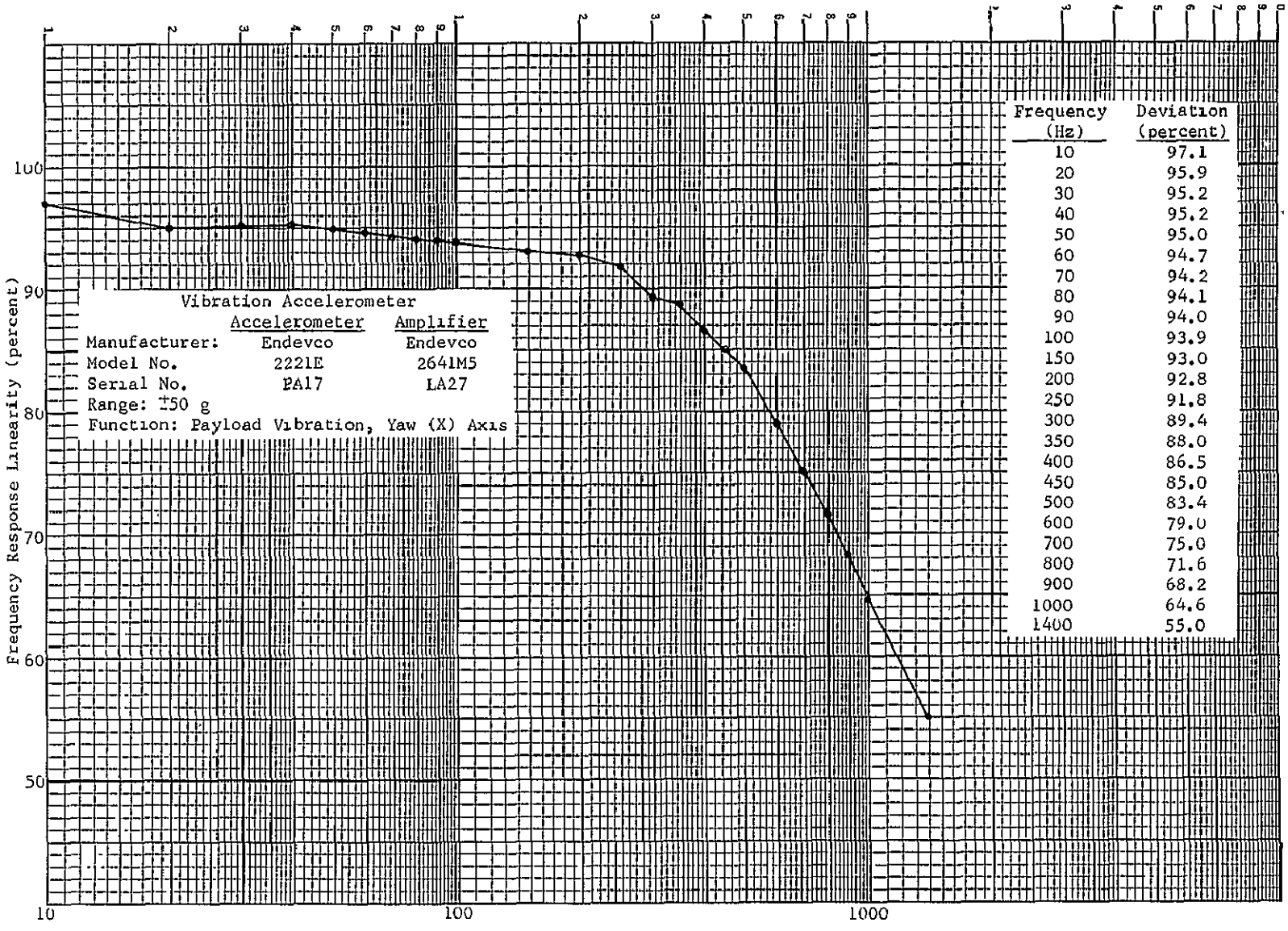


Figure 27. Vibration Accelerometer, Frequency Response for Yaw (X) Axis, at 5g

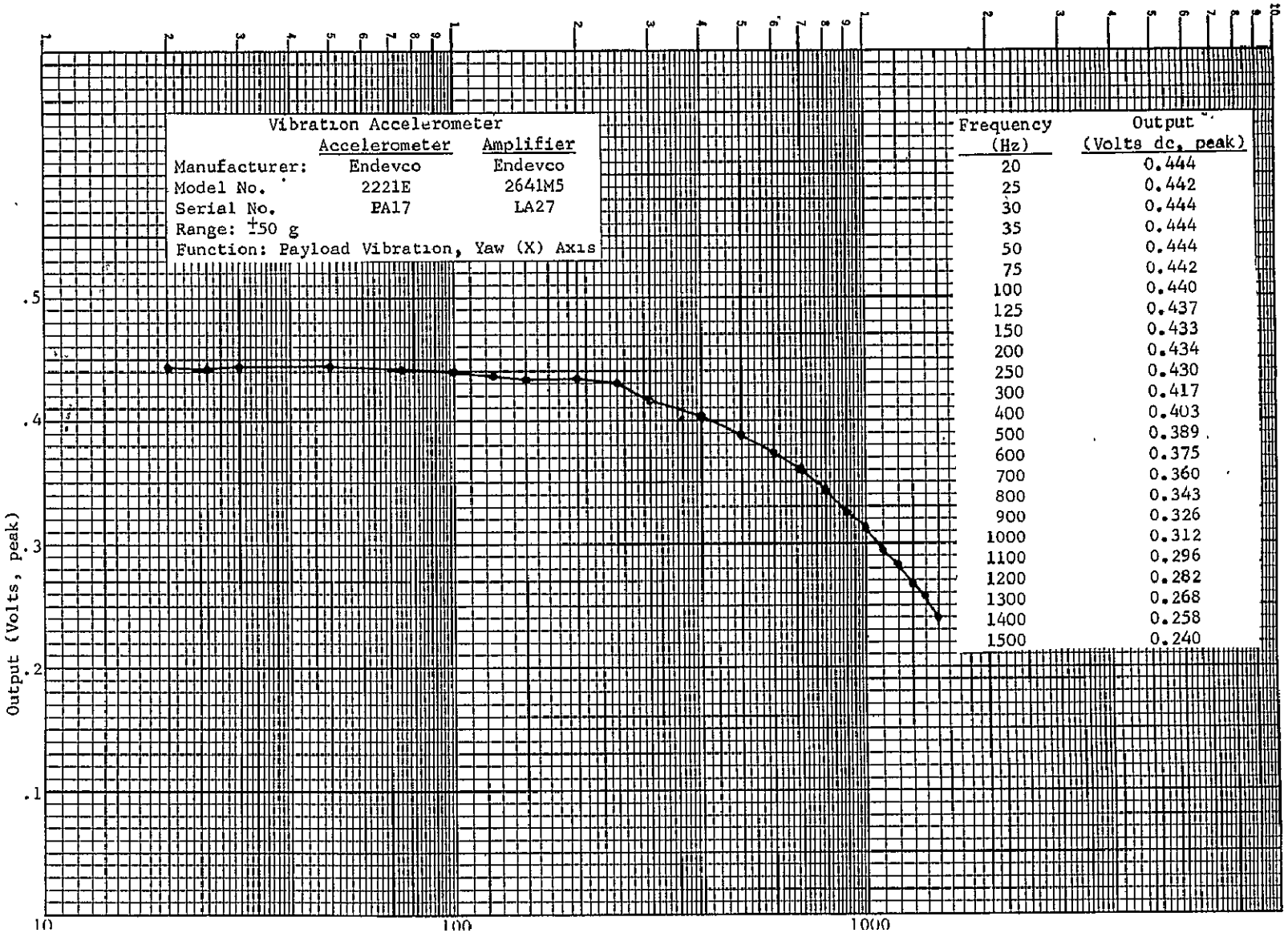


Figure 28. Vibration Accelerometer, Frequency Response for Yaw (X) Axis, at 10 g

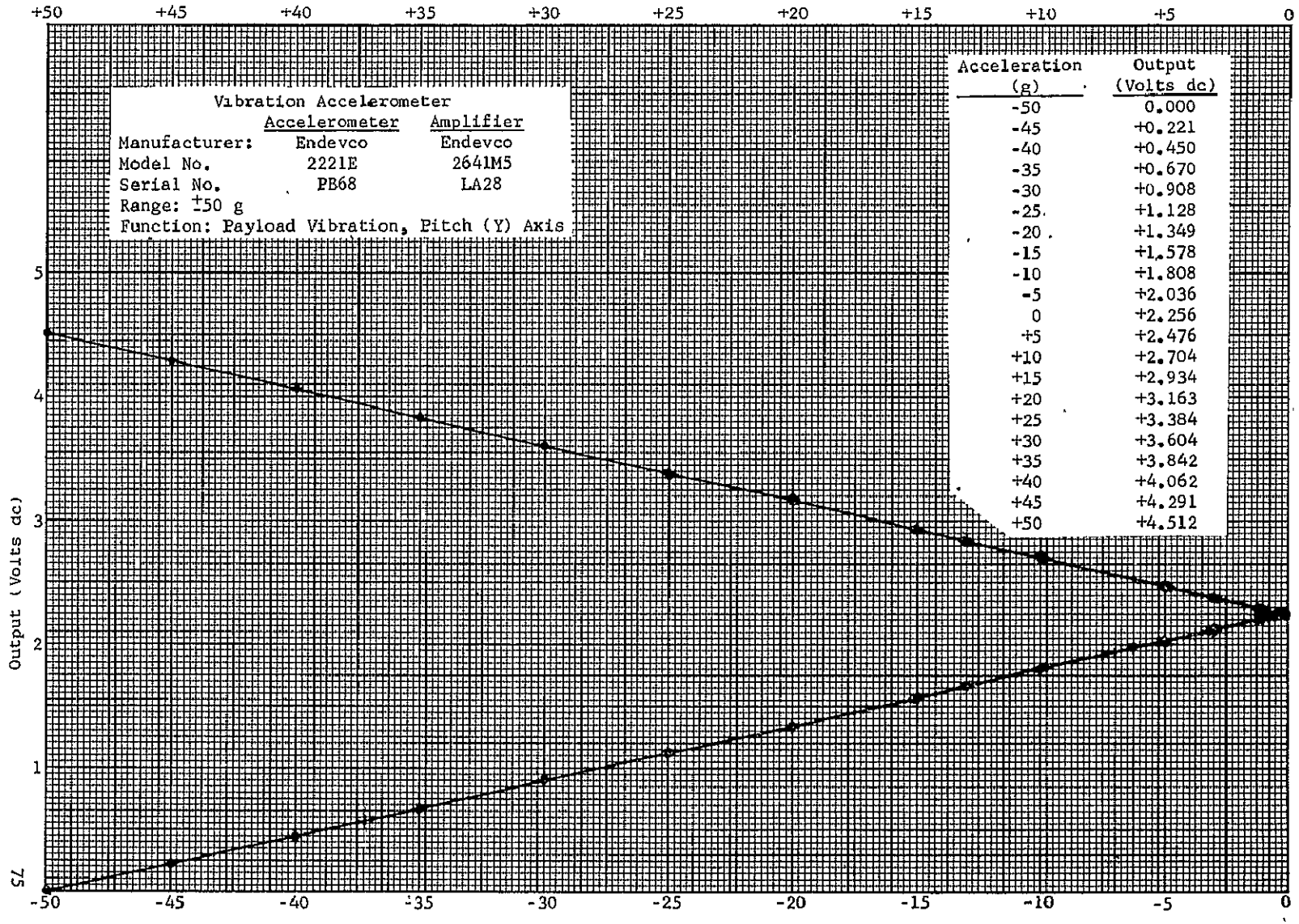


Figure 29. Vibration Accelerometer, Calibration for Pitch (Y) Axis

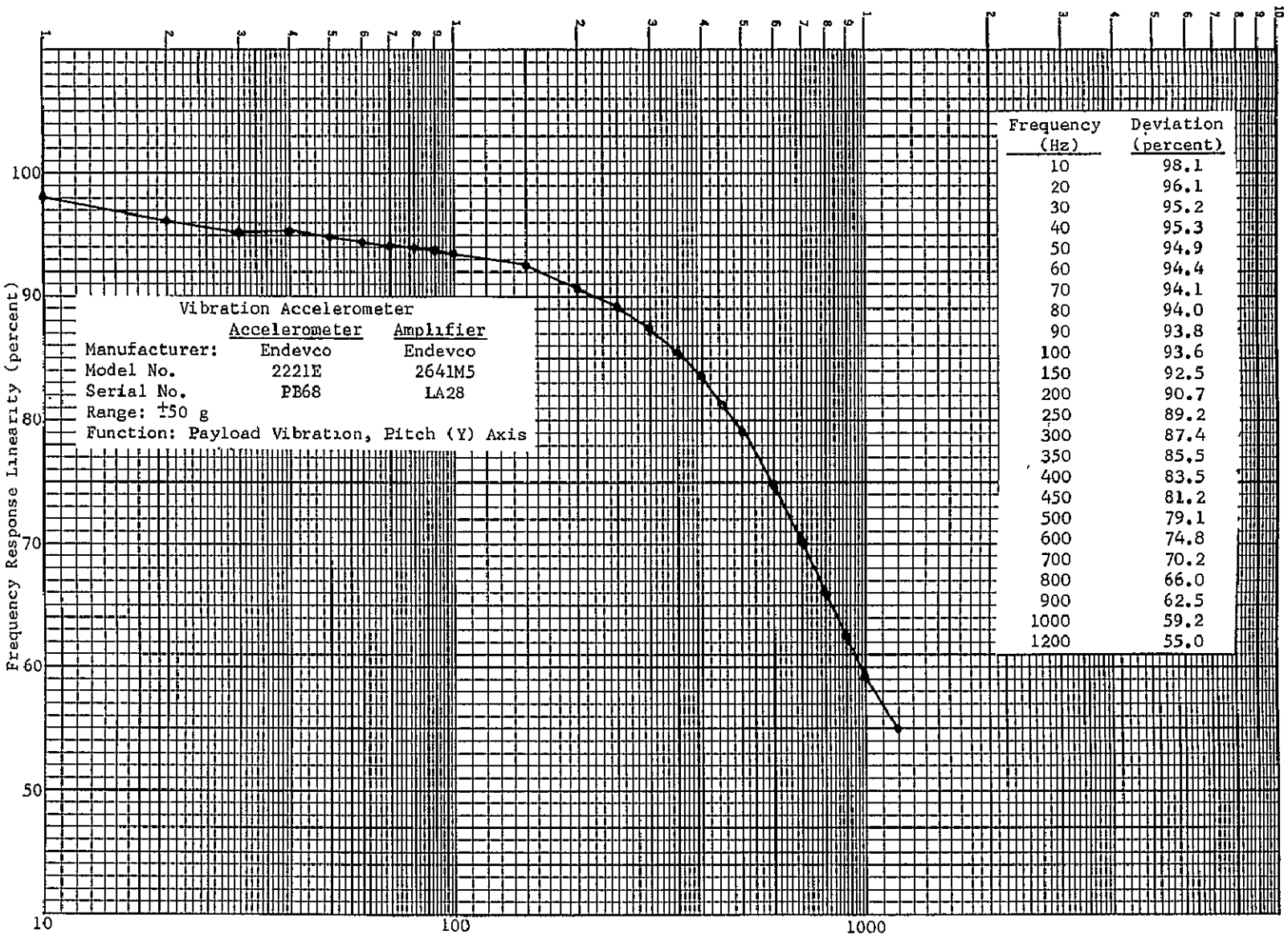


Figure 30. Vibration Accelerometer, Frequency Response for Pitch (Y) Axis, at 5 g

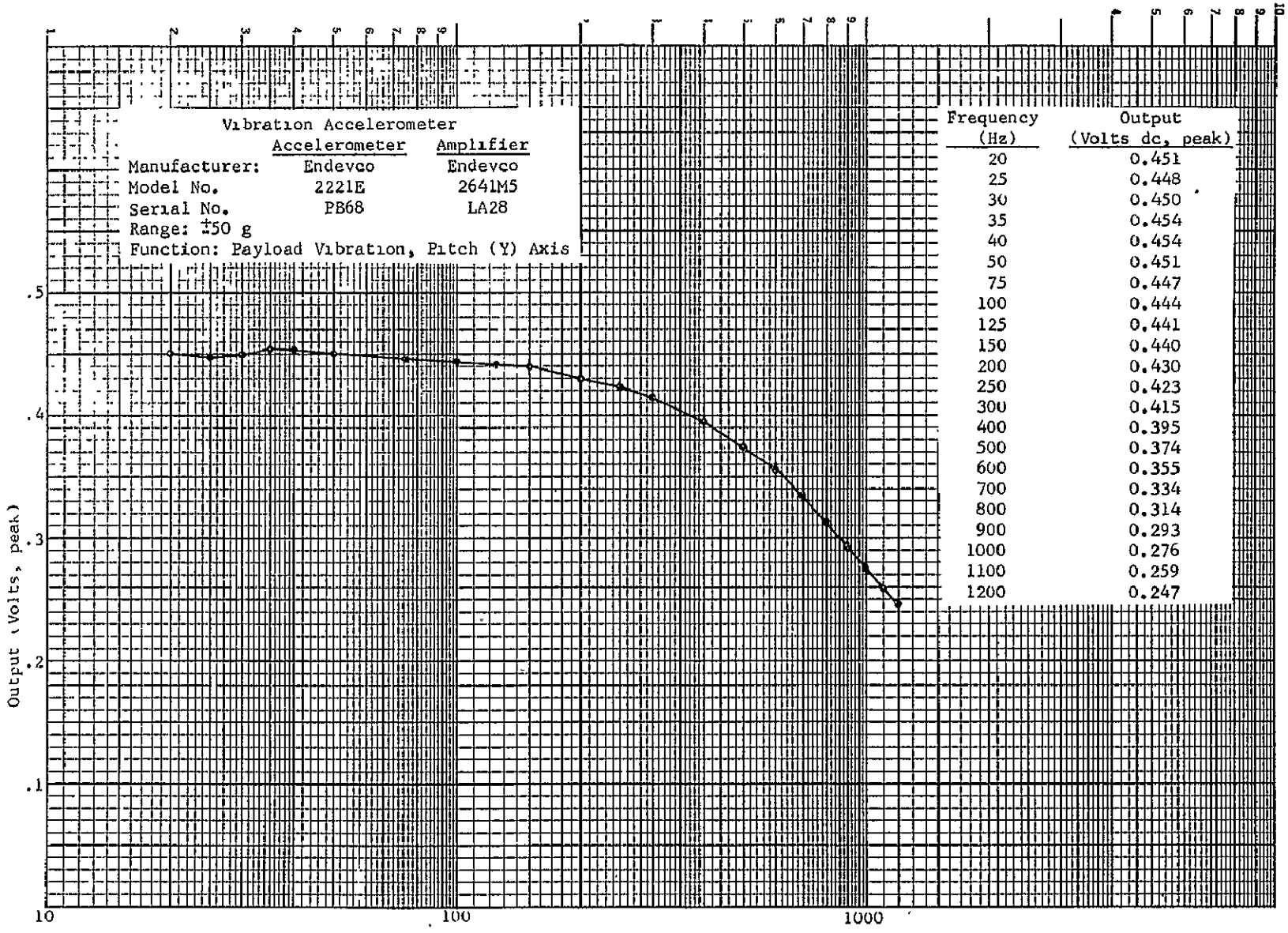


Figure 31. Vibration Accelerometer, Frequency Response for Pitch (Y) Axis, at 10g

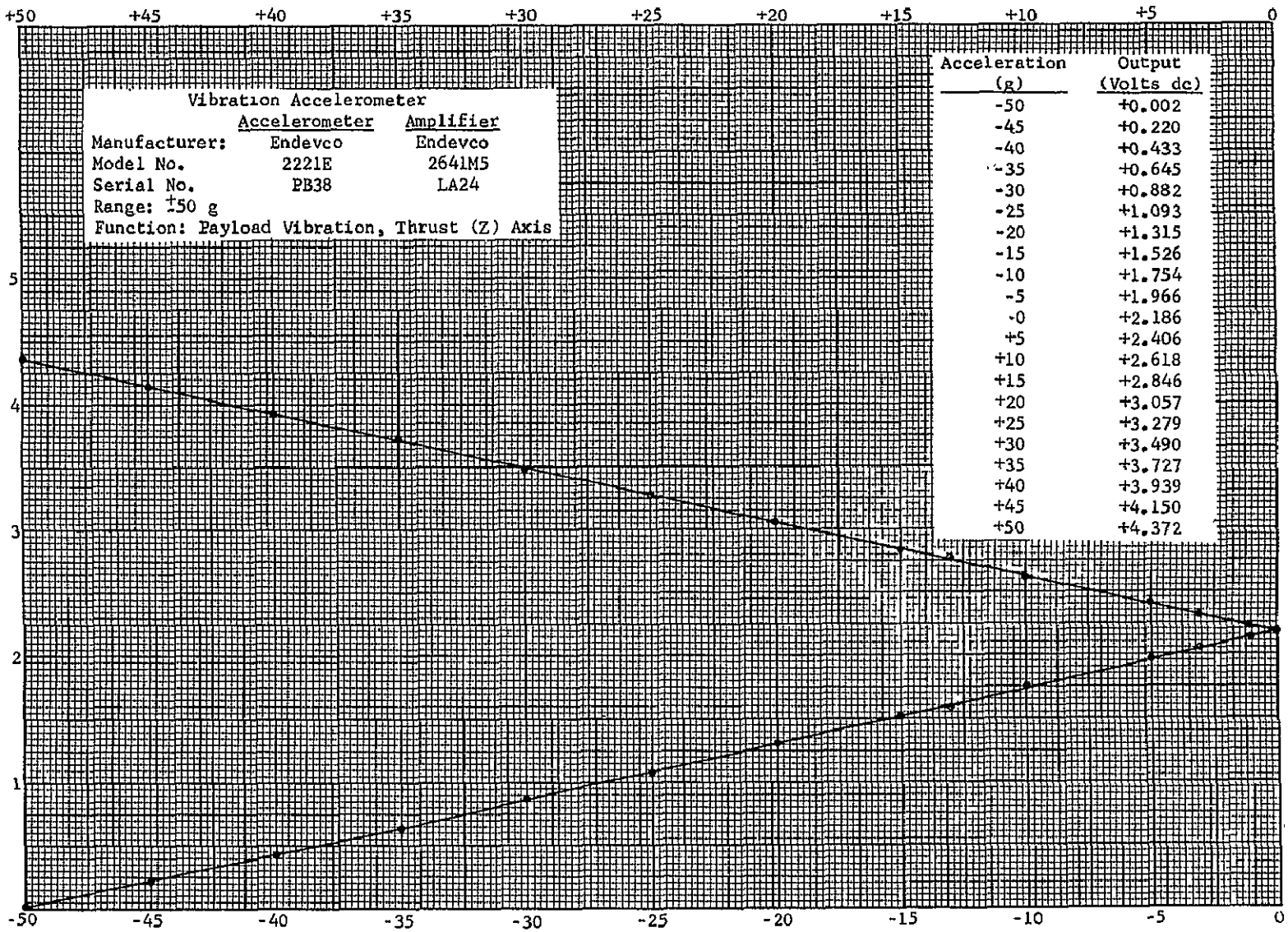


Figure 32. Vibration Accelerometer, Calibration for Thrust (Z) Axis

Figure 33. Vibration Accelerometer, Frequency Response for (... Z) Axis, at 5 g

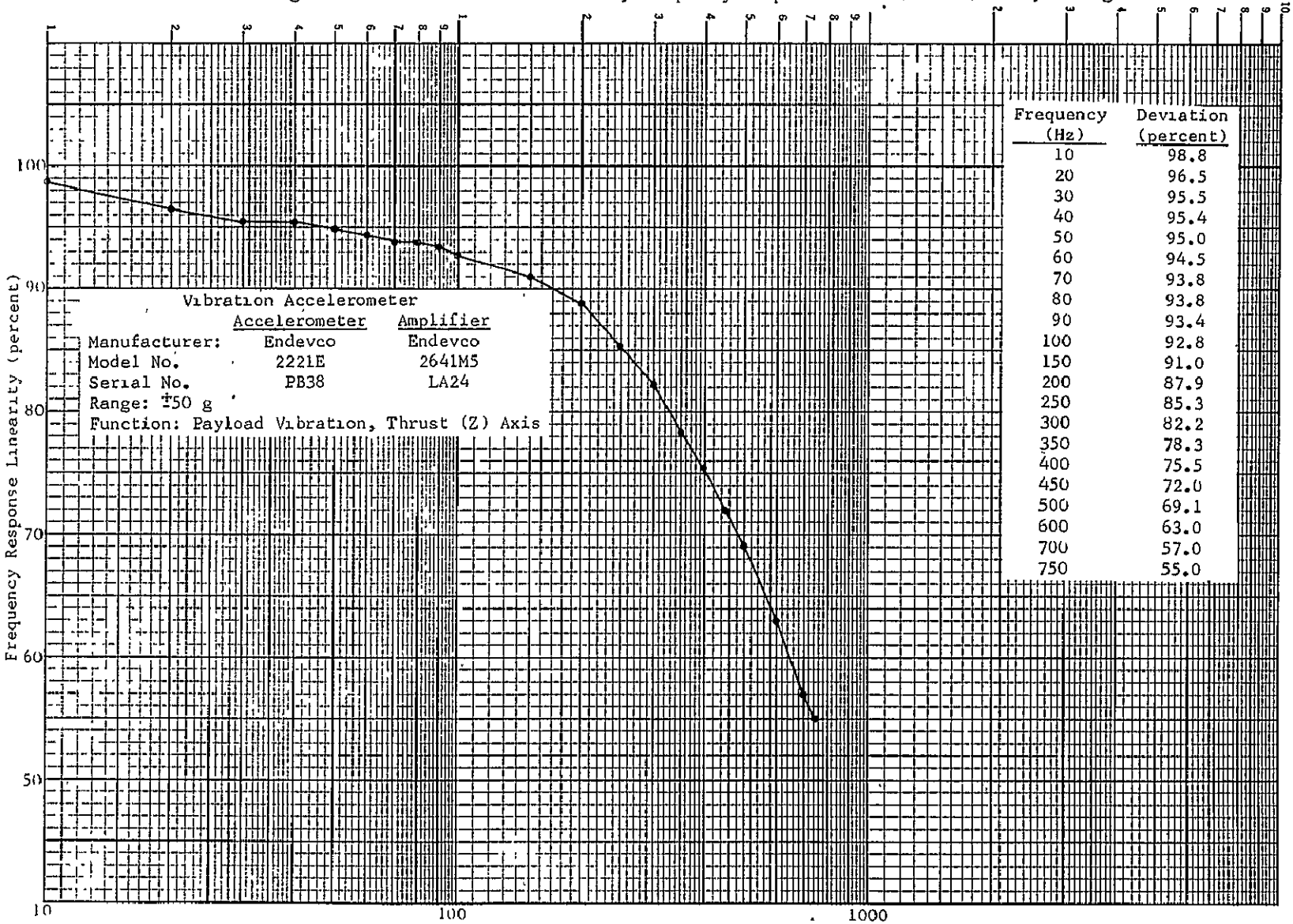


Figure 33. Vibration Accelerometer, Frequency Response for Thrust (Z) Axis, at 5 g

Figure 34. Vibration Accelerometer, Frequency Response for Thrust (Z) Axis, at 10 g

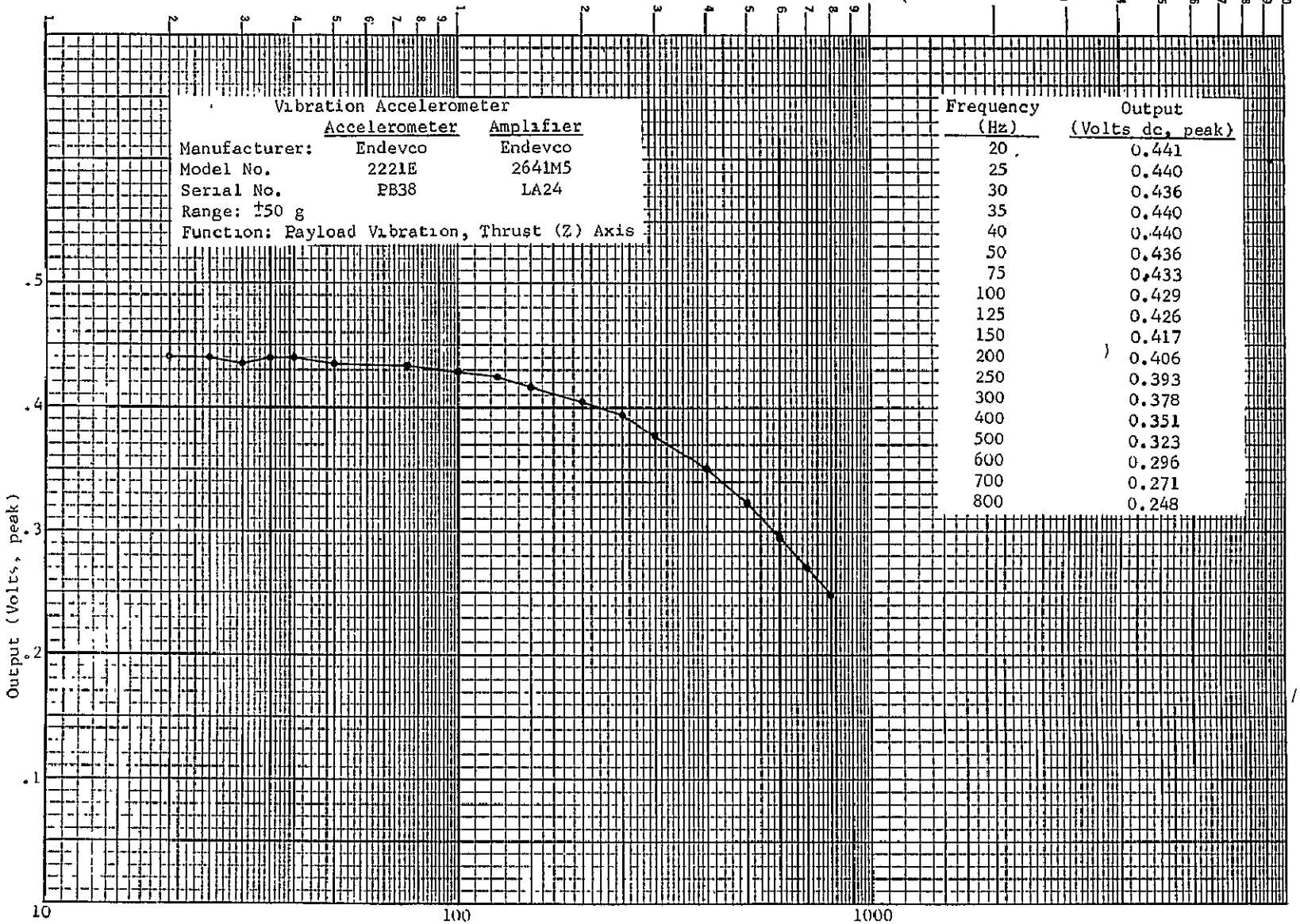
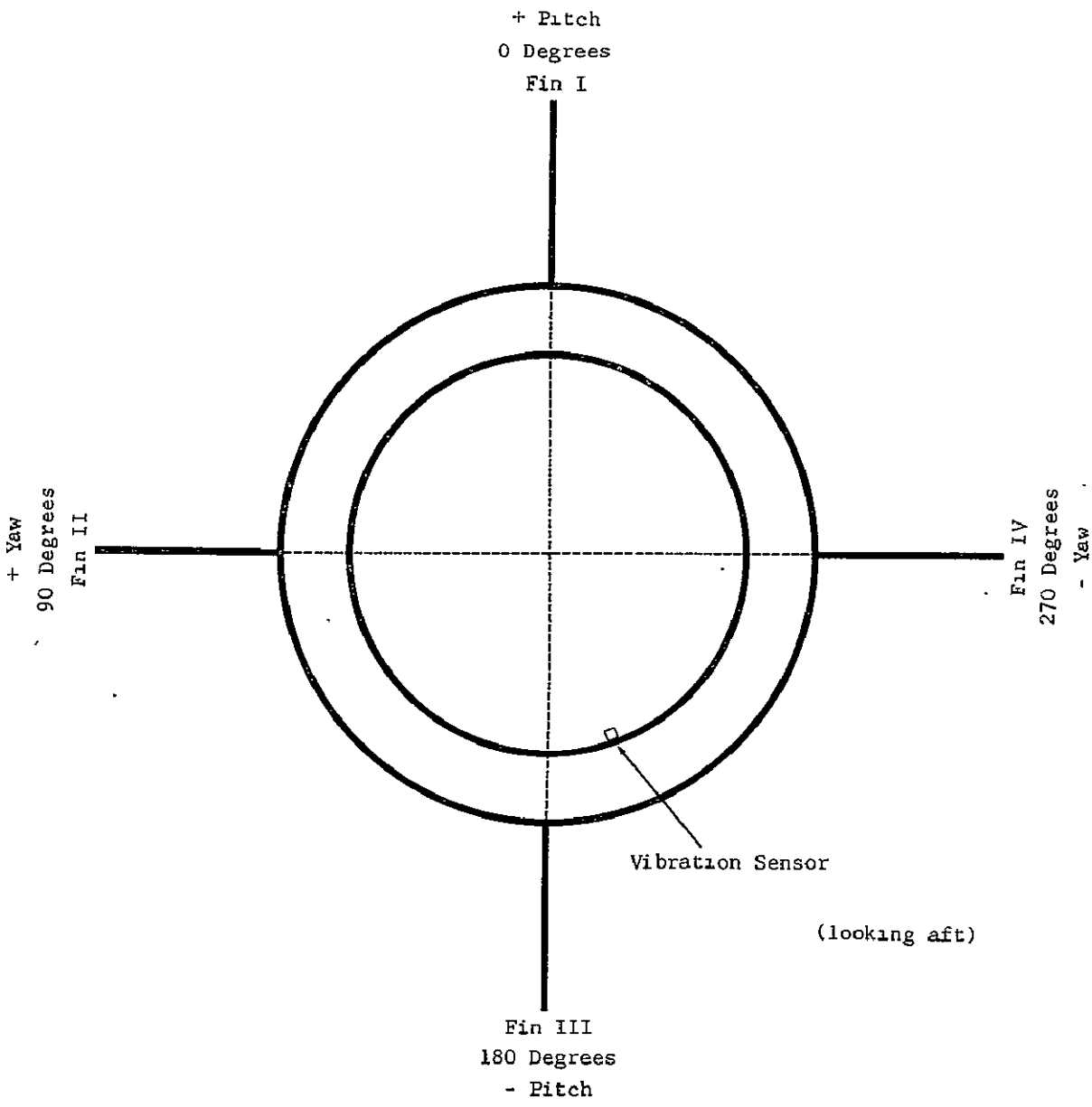


Figure 34. Vibration Accelerometer, Frequency Response for Thrust (Z) Axis, at 10g



Sensor is mounted on the Electronic Chassis of the Recovery System

Figure 35. Vibration Acceleration Sensor (Recovery System), Orientation on Flight 17.05GT-GG

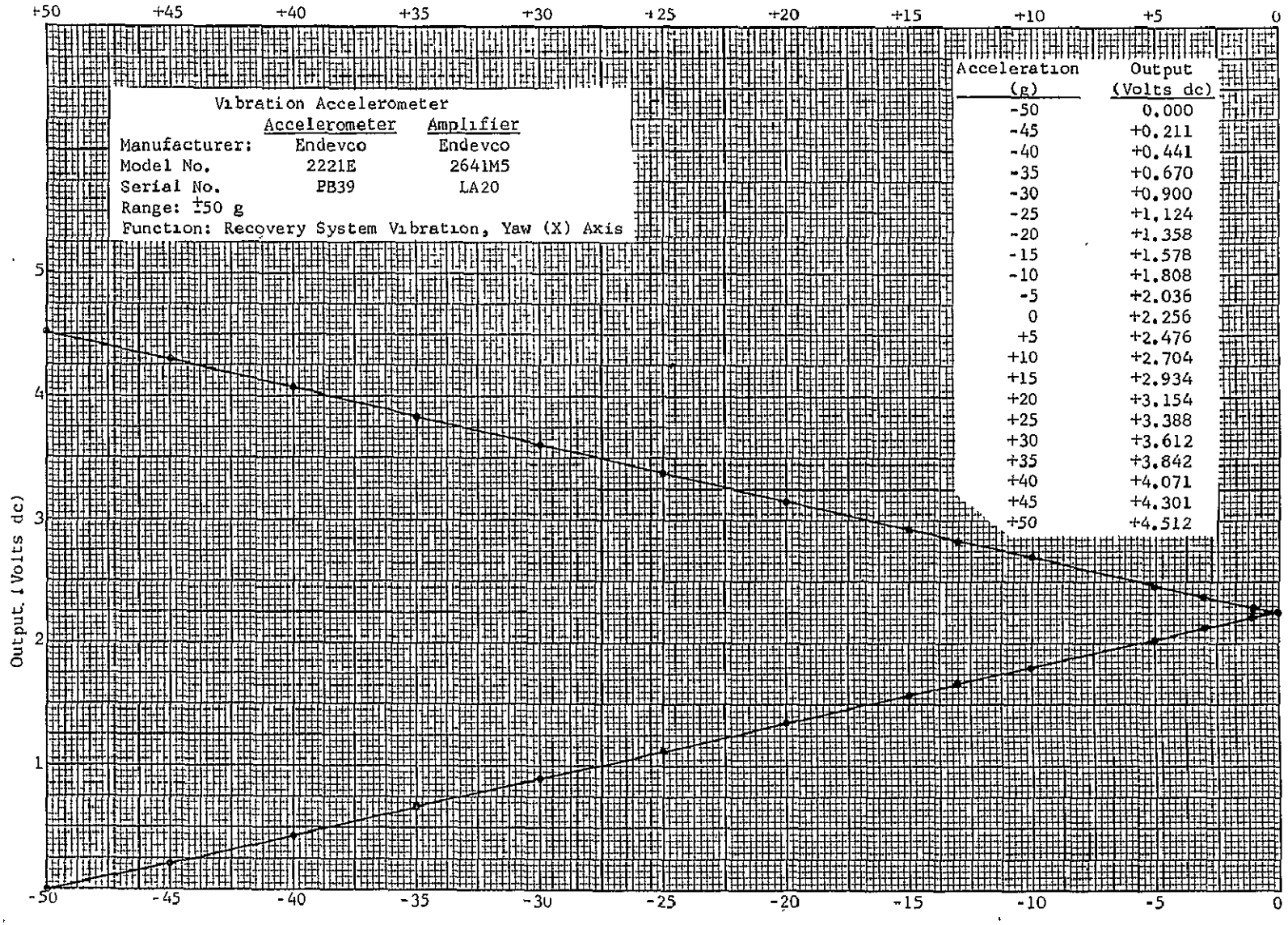


Figure 36. Vibration Accelerometer (Recovery System), Calibration for Yaw (X) Axis

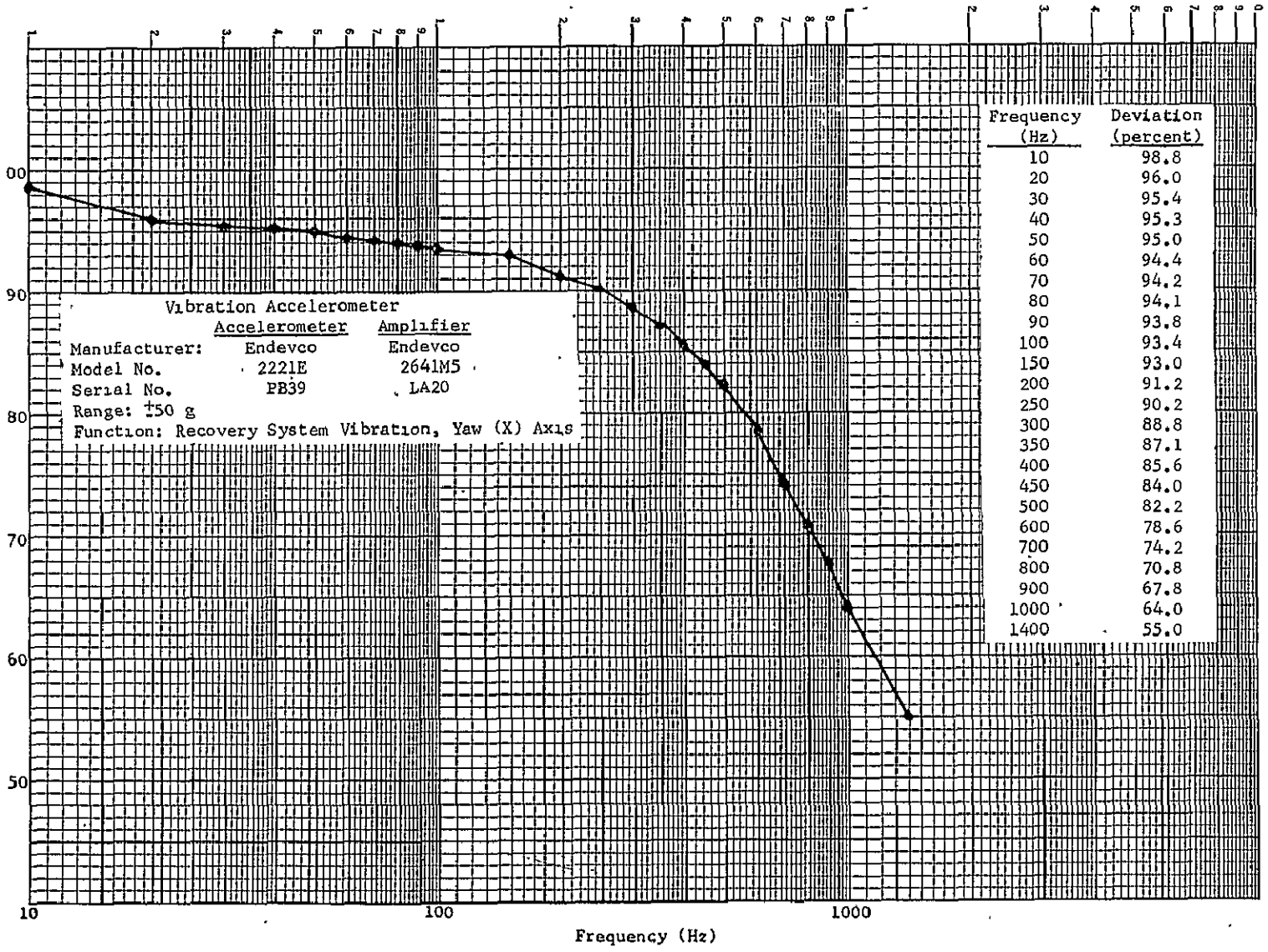


Figure 37. Vibration Accelerometer (Recovery System), Frequency Response for Yaw (X) Axis, at 5 g

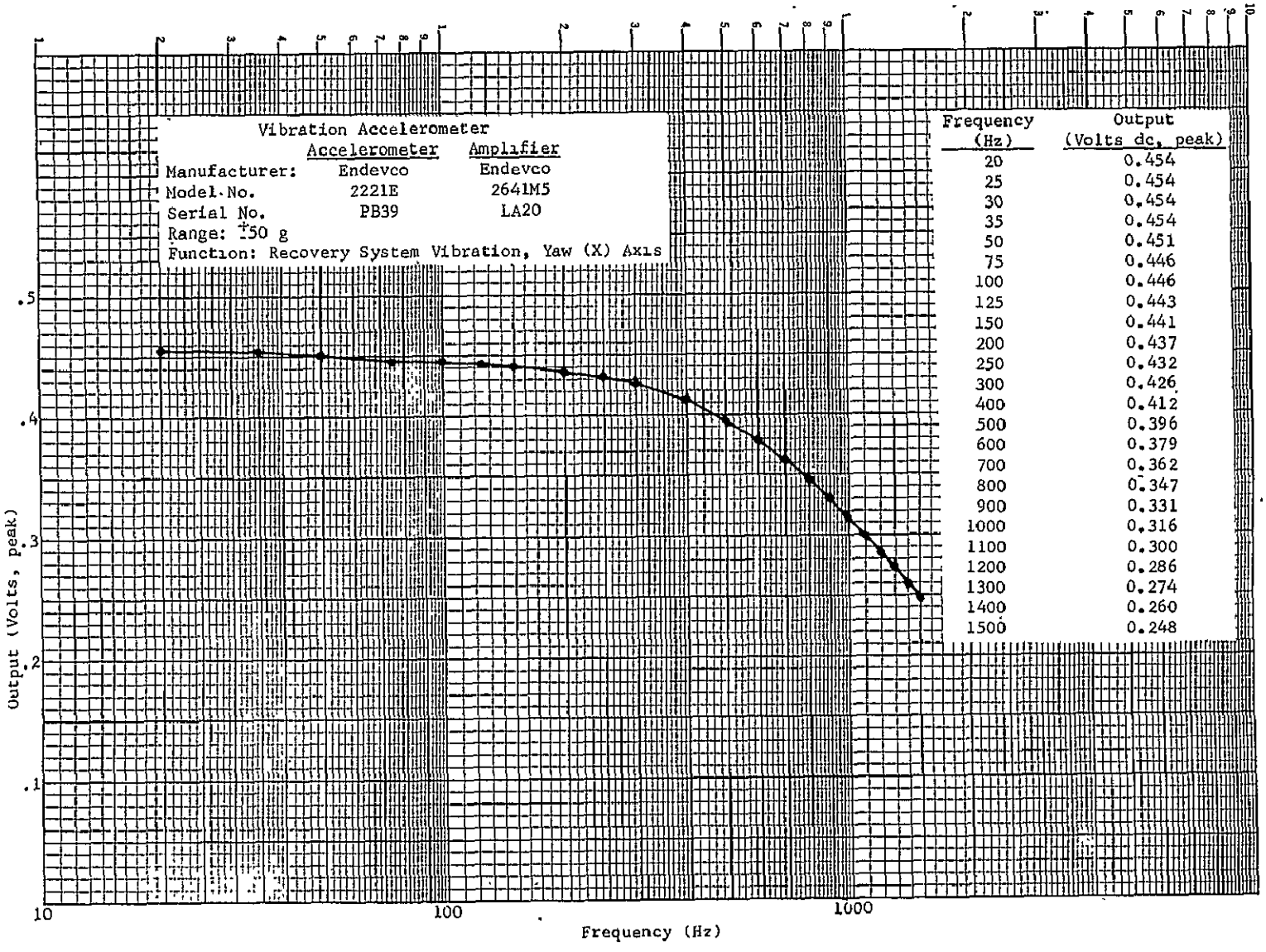


Figure 38. Vibration Accelerometer (Recovery System), Frequency Response for Yaw (X) Axis, at 10g

SECTION IV

PRESSURE INSTRUMENTATION

TABLE 19

PRESSURE GAUGES USED FOR FLIGHT 17.05GT-GG

Sensor	Manufacturer	Model No.	Serial No.	Range (psia)
Pressure Gauge: Chamber (PcI)	Servonic	2901-8001	1066	0 to 600
Pressure Gauge: Chamber (PcII)	Servonic	2901-8001	1075	0 to 600
Pressure Gauge: Chamber (PcIII)	Servonic	2901-8001	1119	0 to 600
Pressure Gauge: Chamber (PcIV)	Servonic	2901-8001	1060	0 to 600
Pressure Gauge: Air Reservoir (Par)	Servonic	2901-9201	1008	0 to 4000
Pressure Gauge: Gas Bottle (Pgb)	Edcliff	120165	924	0 to 4000
Pressure Gauge: Gas Regulator (Pgr)	Servonic	2901-8001	1120	0 to 600
Pressure Gauge: Manifold (Pman)	Gulton	3031-10201	1009	0 to 15
Pressure Gauge: Body (PbI)	Gulton	3031-10201	1006	0 to 15
Pressure Gauge: Body (PbII)	Gulton	3031-10201	1007	0 to 15
Pressure Gauge: Body (PbIII)	Gulton	3031-10201	1008	0 to 15

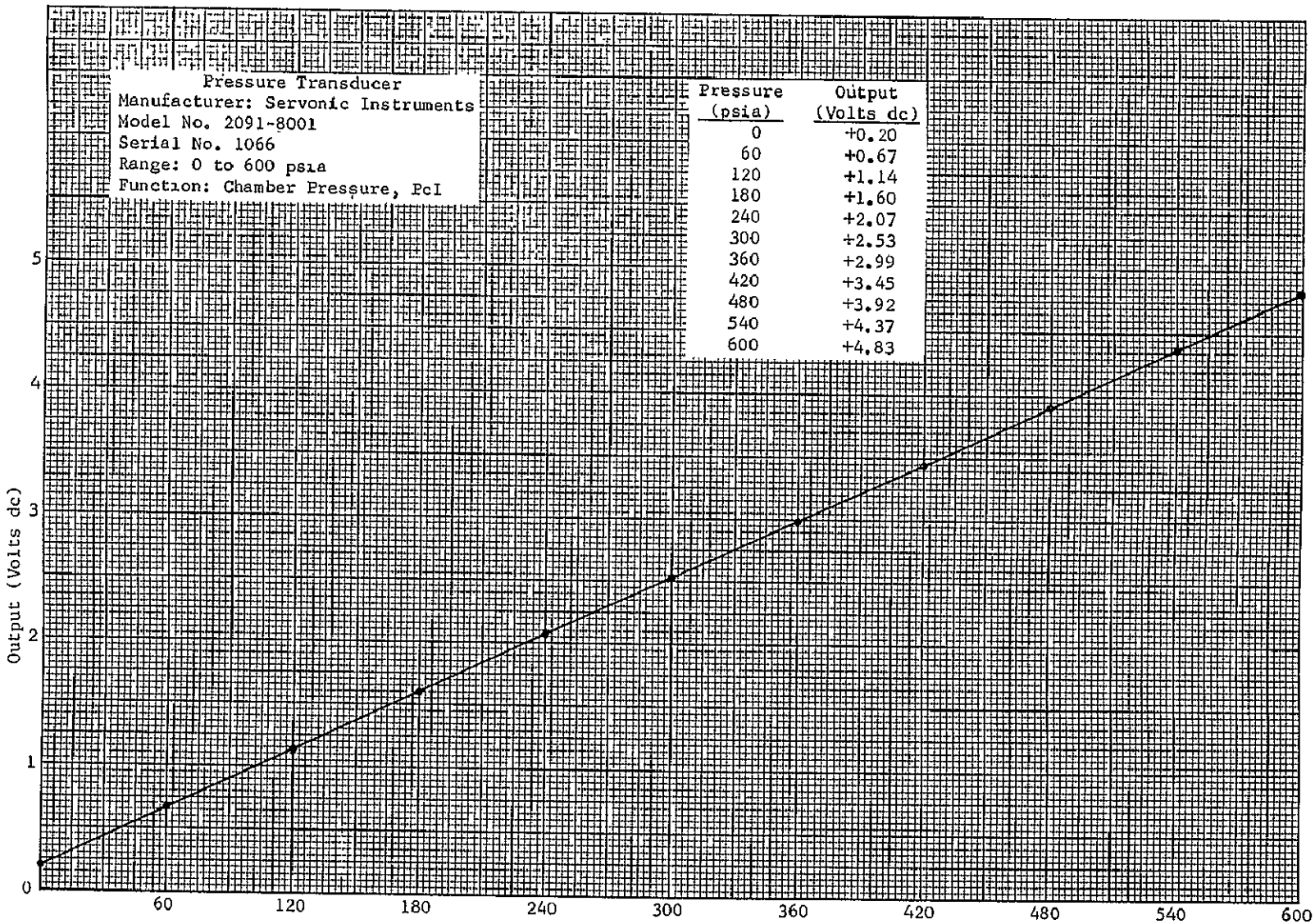


Figure 39. Pressure Transducer, Calibration for Chember Pressure (Pcl)

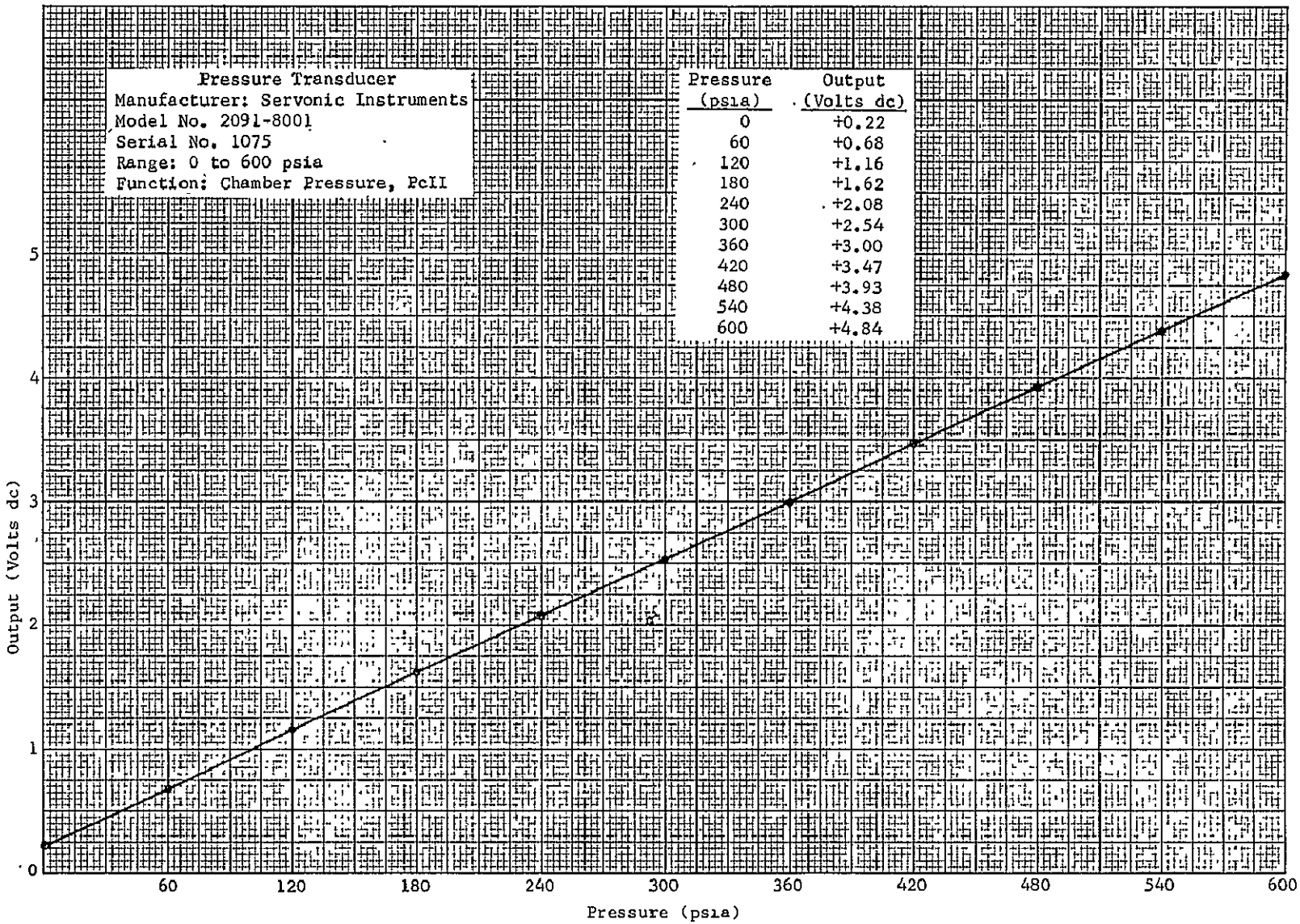


Figure 40. Pressure Transducer, Calibration for Chamber Pressure (PcII)

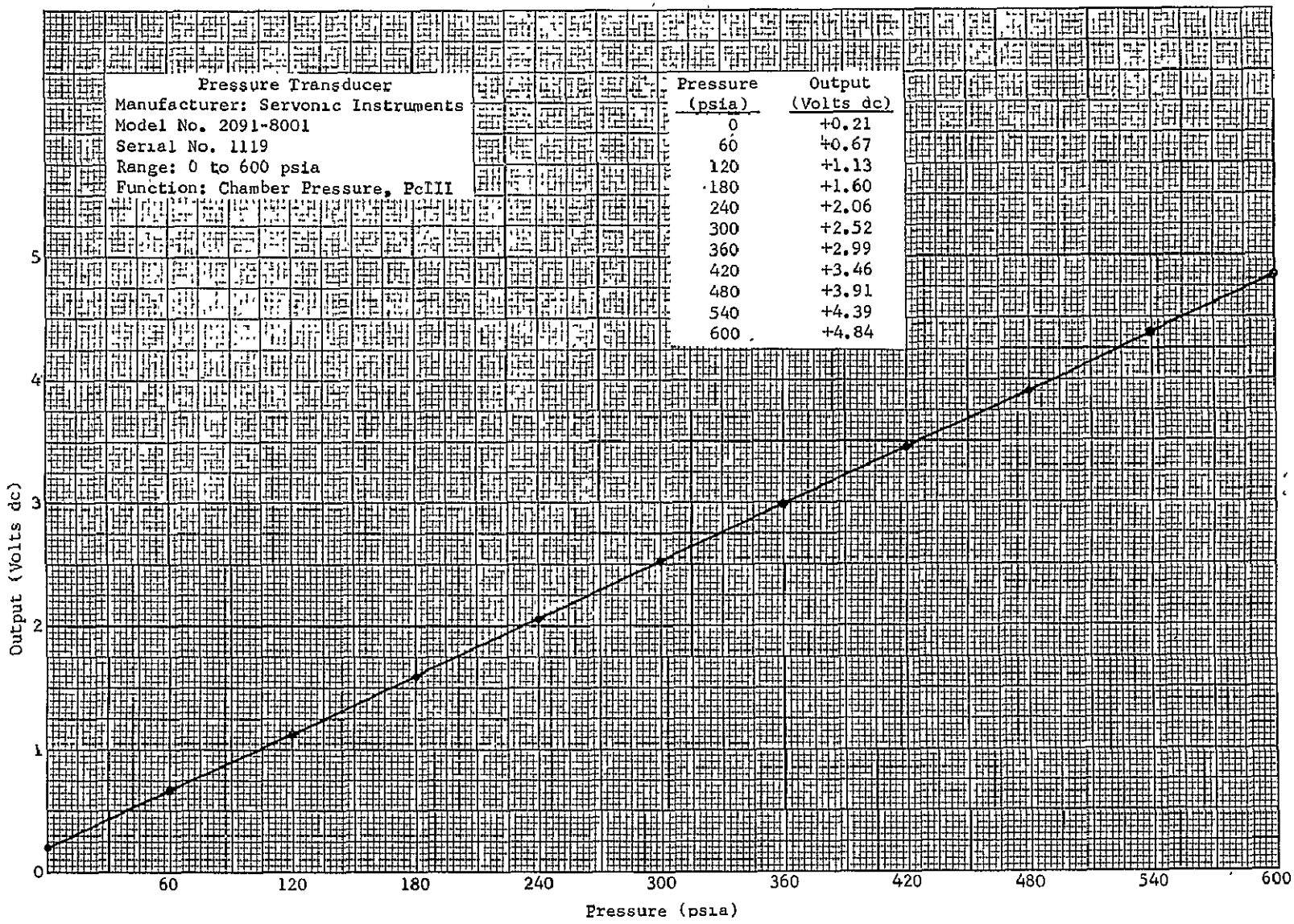


Figure 41. Pressure Transducer, Calibration for Chamber Pressure (PcIII)

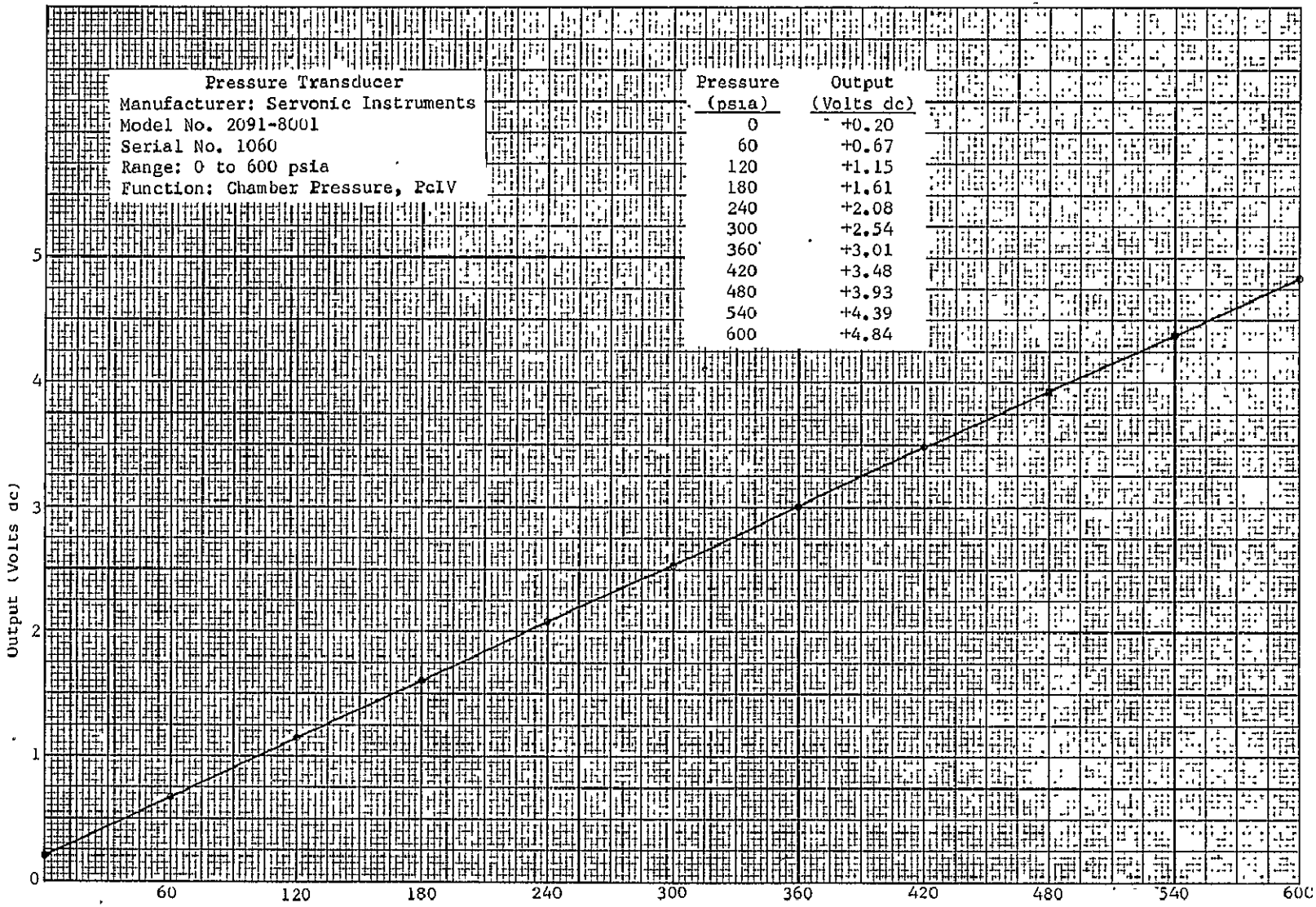


Figure 42. Pressure Transducer, Calibration for Chamber Pressure (PcIV)

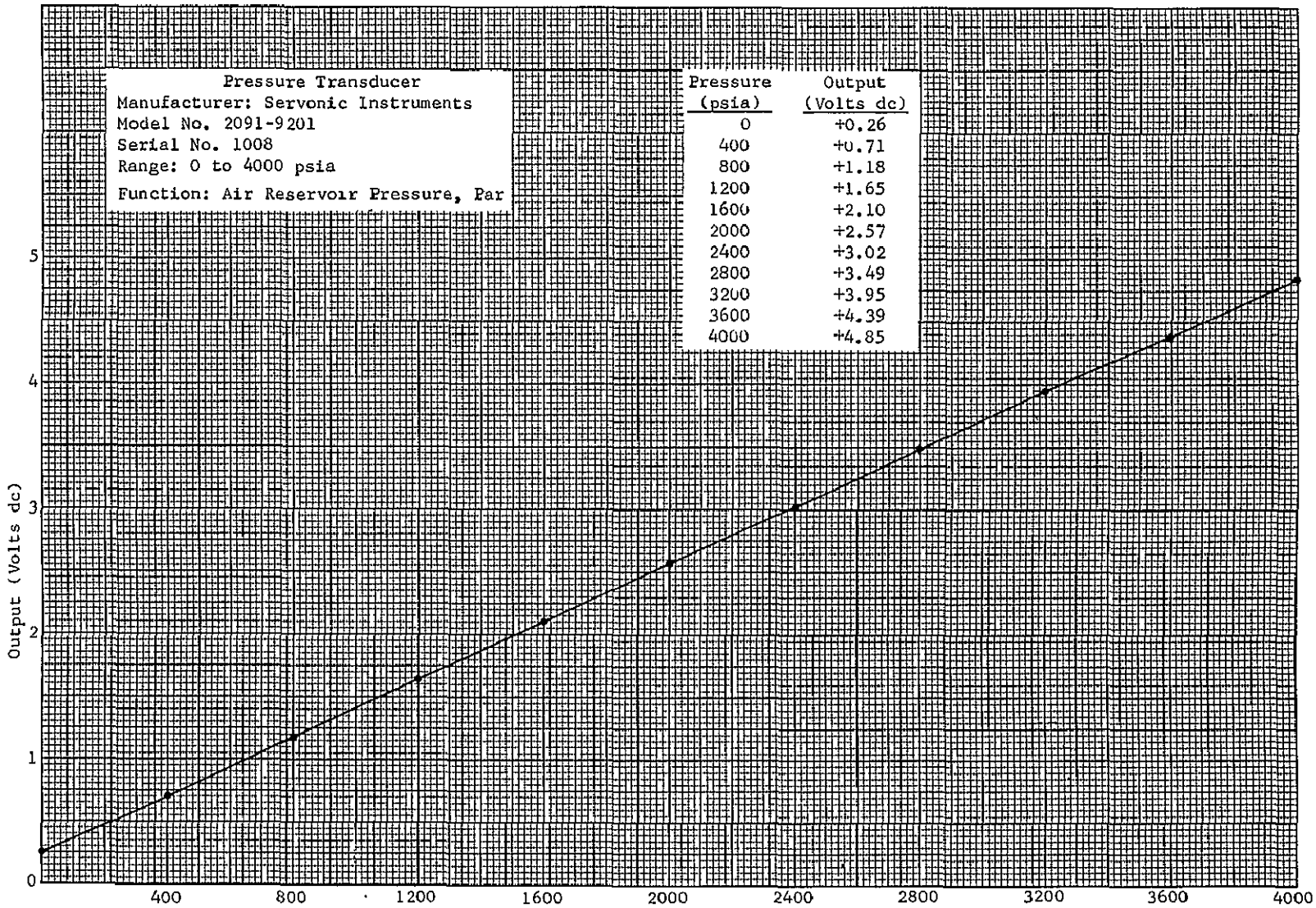


Figure 43. Pressure Transducer, Calibration for Air Reservoir Pressure (Par)

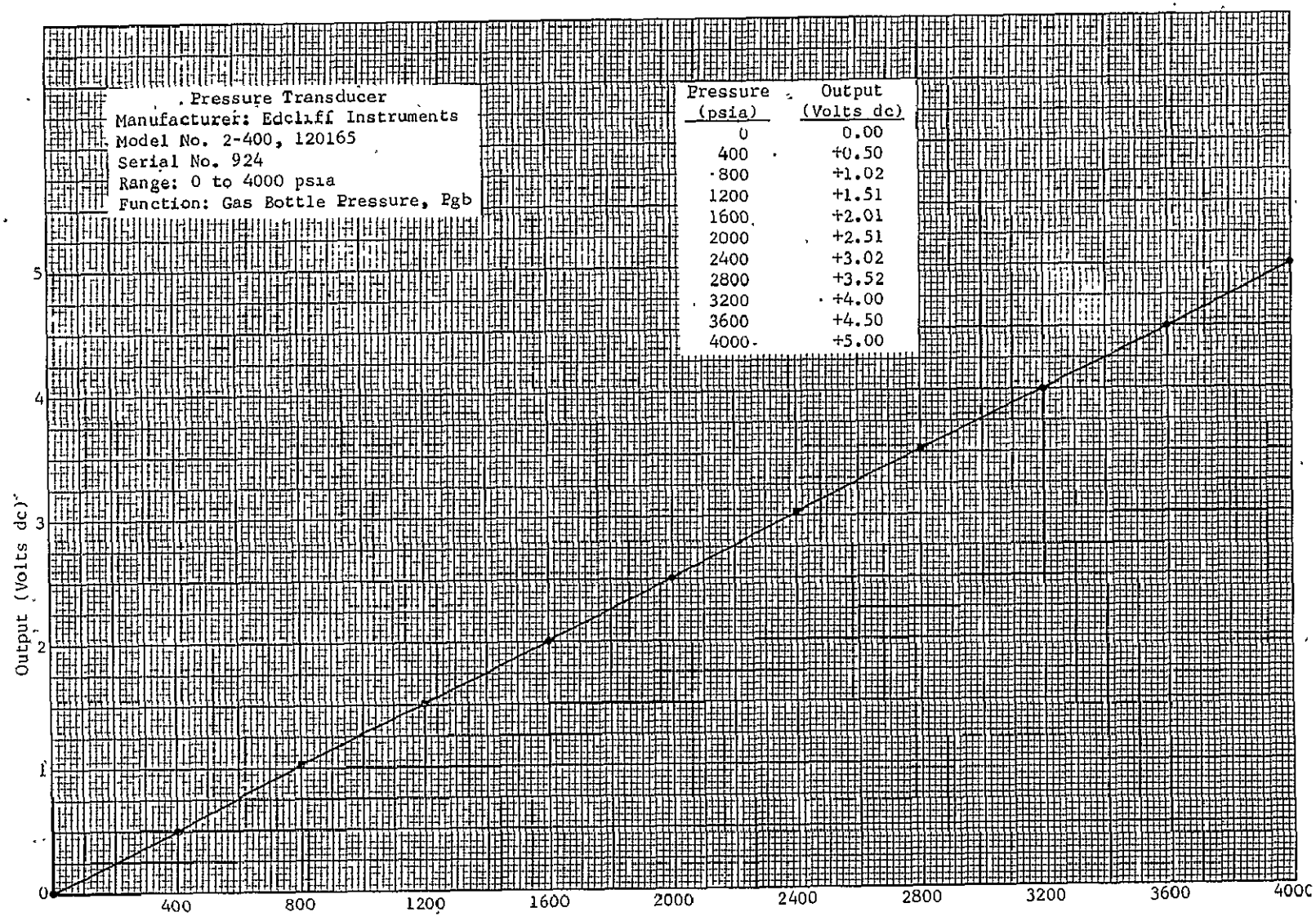


Figure 44. Pressure Transducer, Calibration for Gas Bottle Pressure (Pgb)

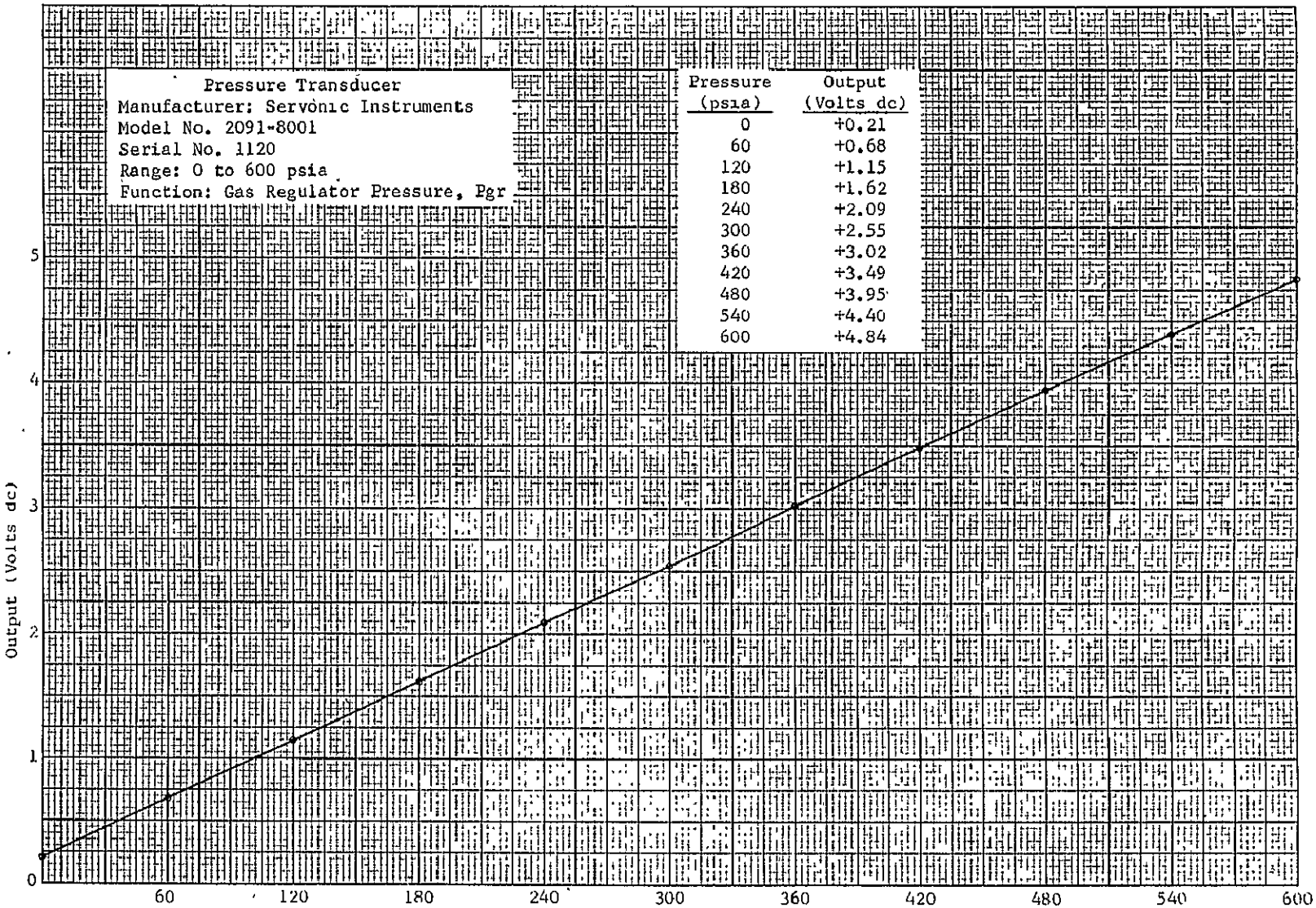


Figure 45. Pressure Transducer, Calibration for Gas Regulator Pressure (Pgr)

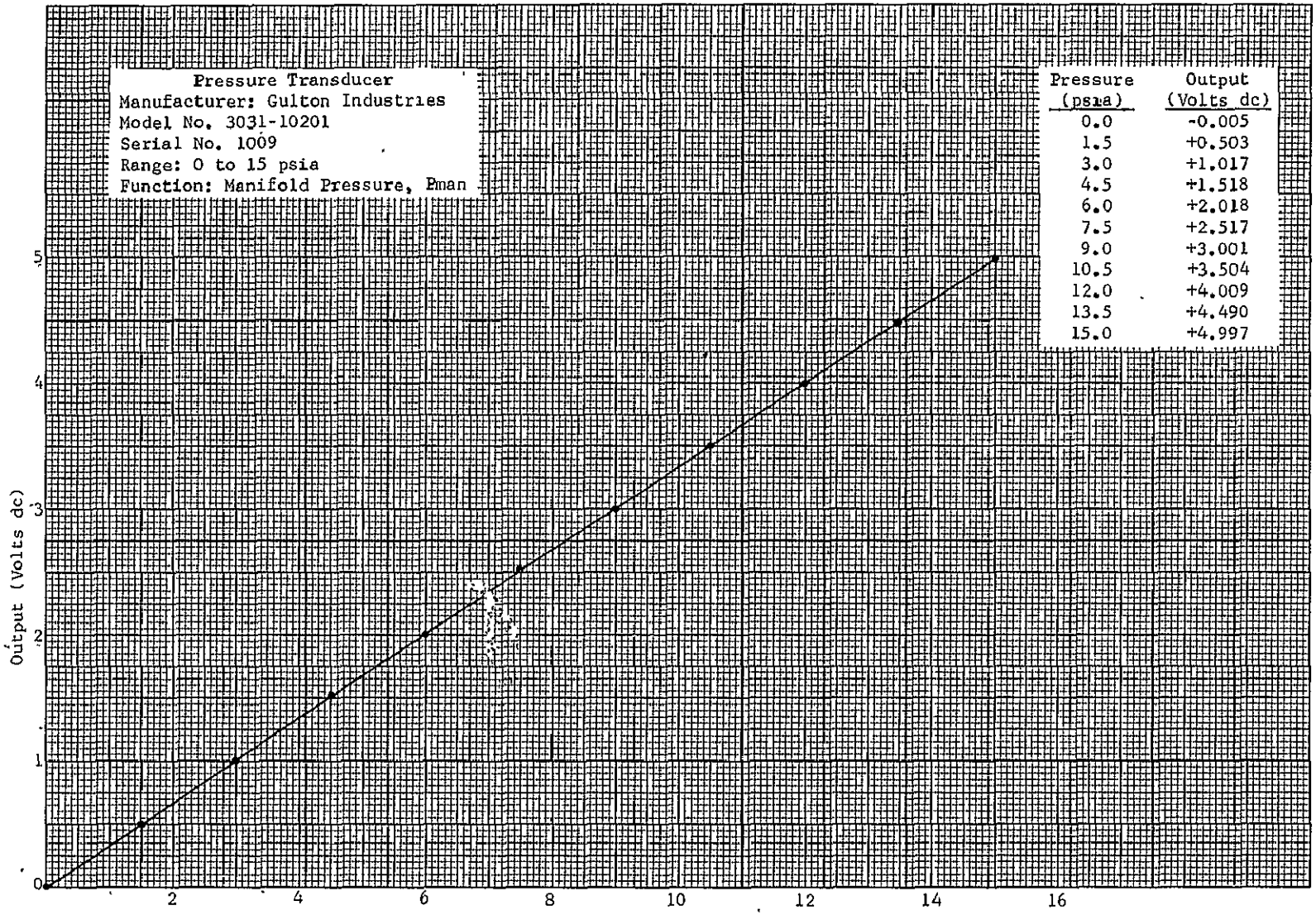


Figure 46. Pressure Transducer, Calibration for Manifold Pressure (Pman)

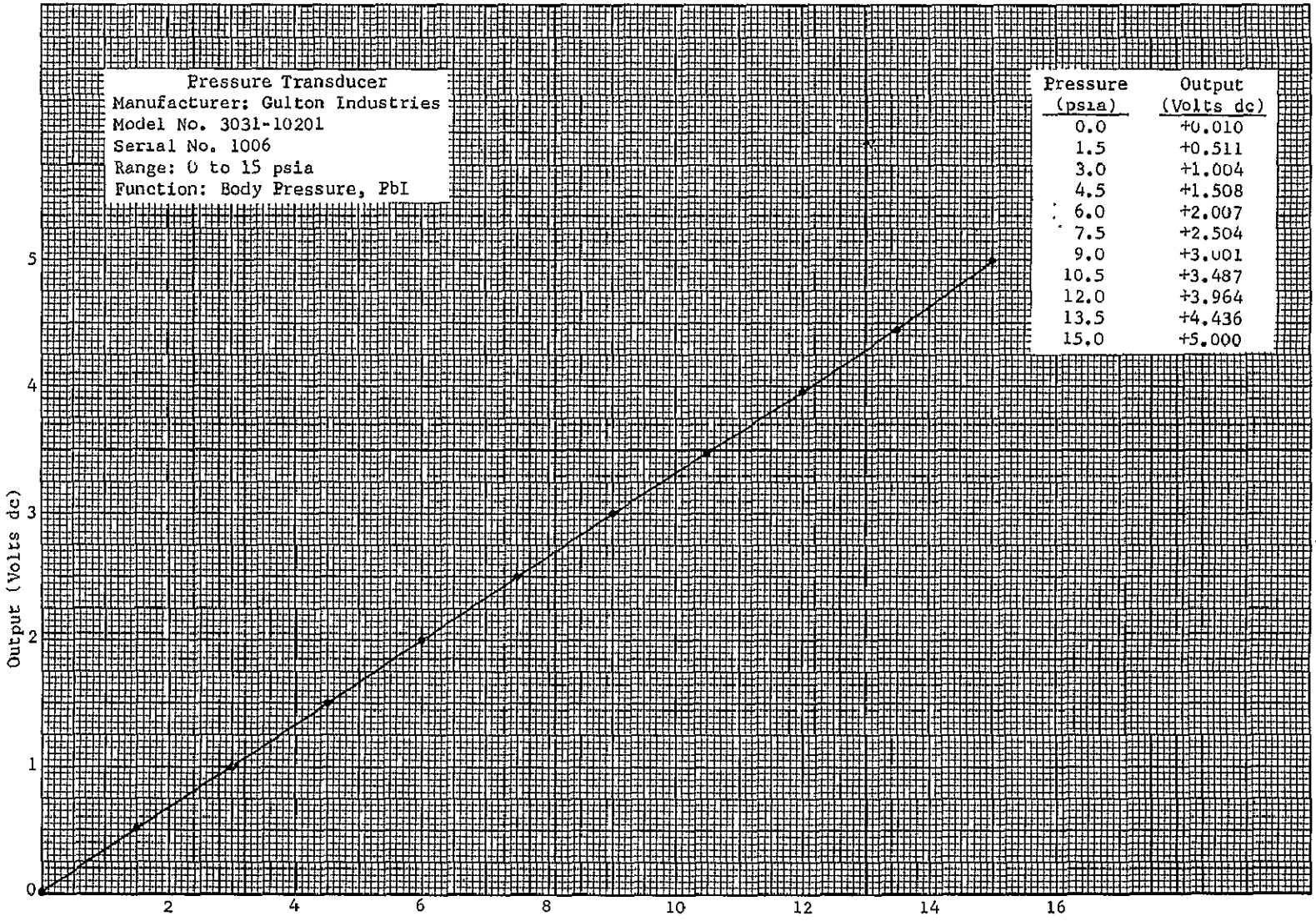


Figure 47. Pressure Transducer, Calibration for Body Pressure (PbI)

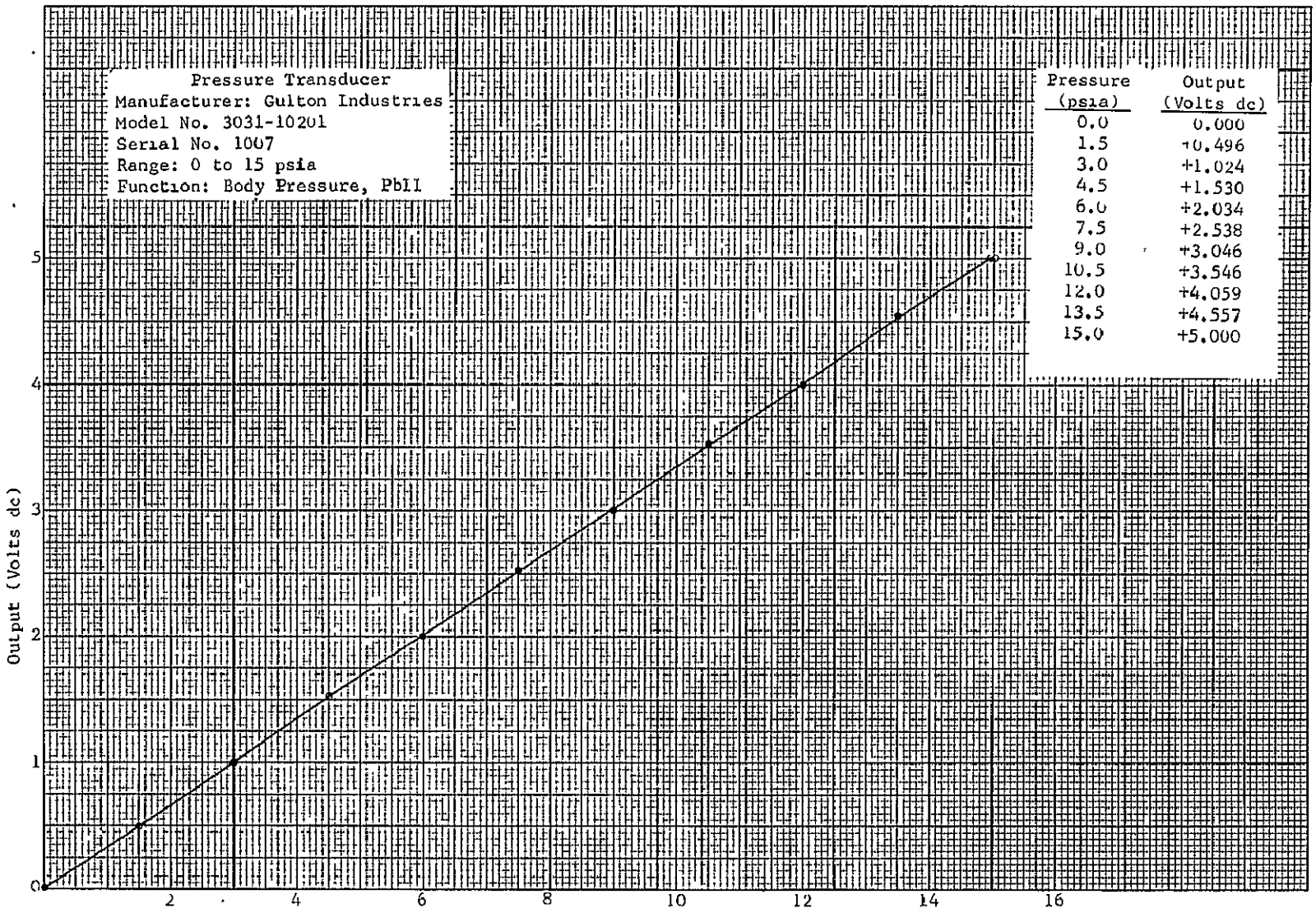


Figure 48. Pressure Transducer, Calibration for Body Pressure (PbII)

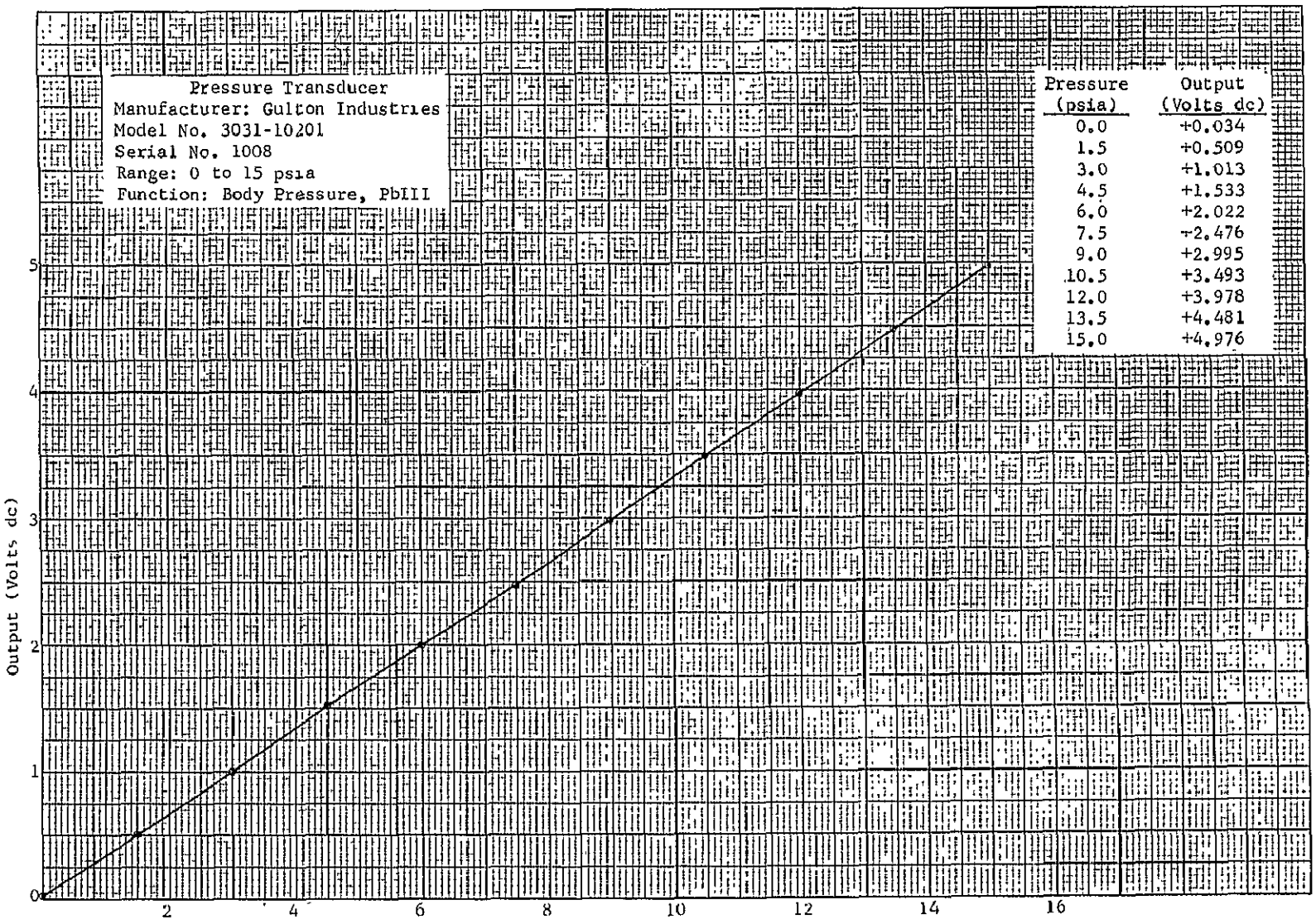


Figure 49. Pressure Transducer, Calibration for Body Pressure (PbIII)

SECTION V

STRAIN GAUGE INSTRUMENTATION

TABLE 20

VEHICLE STRAIN-GAUGES USED FOR FLIGHT 17.05GT-GG

Sensor	Manufacturer	Model No.	Serial No.	Range $(lbs/in)^3$
Strain Gauge 1	Electro-Dev.	2-481	735	0 to 45
Strain Gauge 2	Electro-Dev.	2-481	723	0 to 45
Strain Gauge 3	Electro-Dev.	2-481	734	0 to 45
Strain Gauge 4	Electro-Dev.	2-481	730	0 to 45
Strain Gauge 5	Electro-Dev.	2-481	3074	0 to 45
Strain Gauge 6	Electro-Dev.	2-481	3076	0 to 45
Strain Gauge 7	Electro-Dev.	2-481	3035	0 to 45
Strain Gauge 8	Electro-Dev.	2-481	3042	0 to 45

FOLDOUT FRAME 1

FOLDOUT FRAME 2

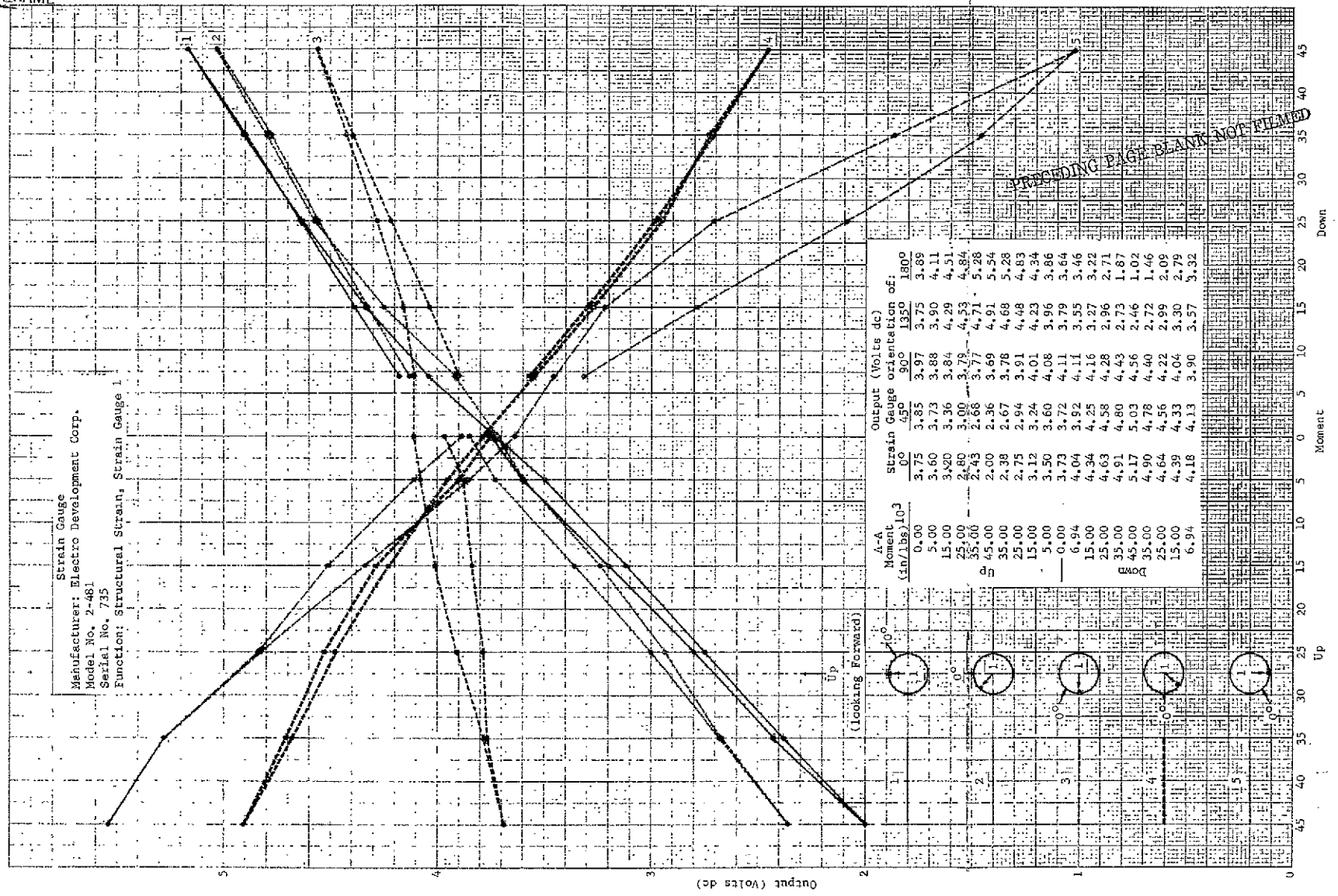
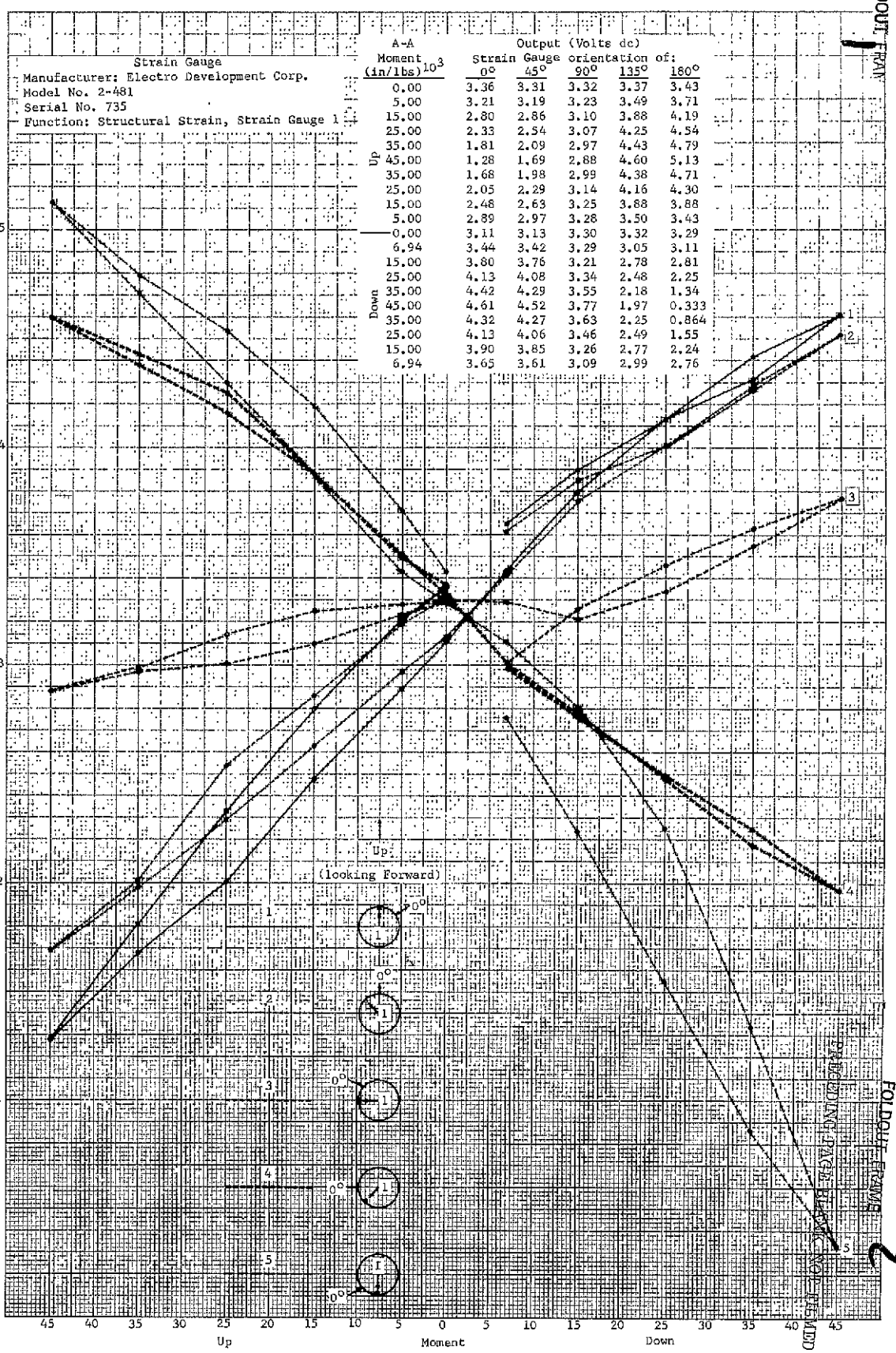
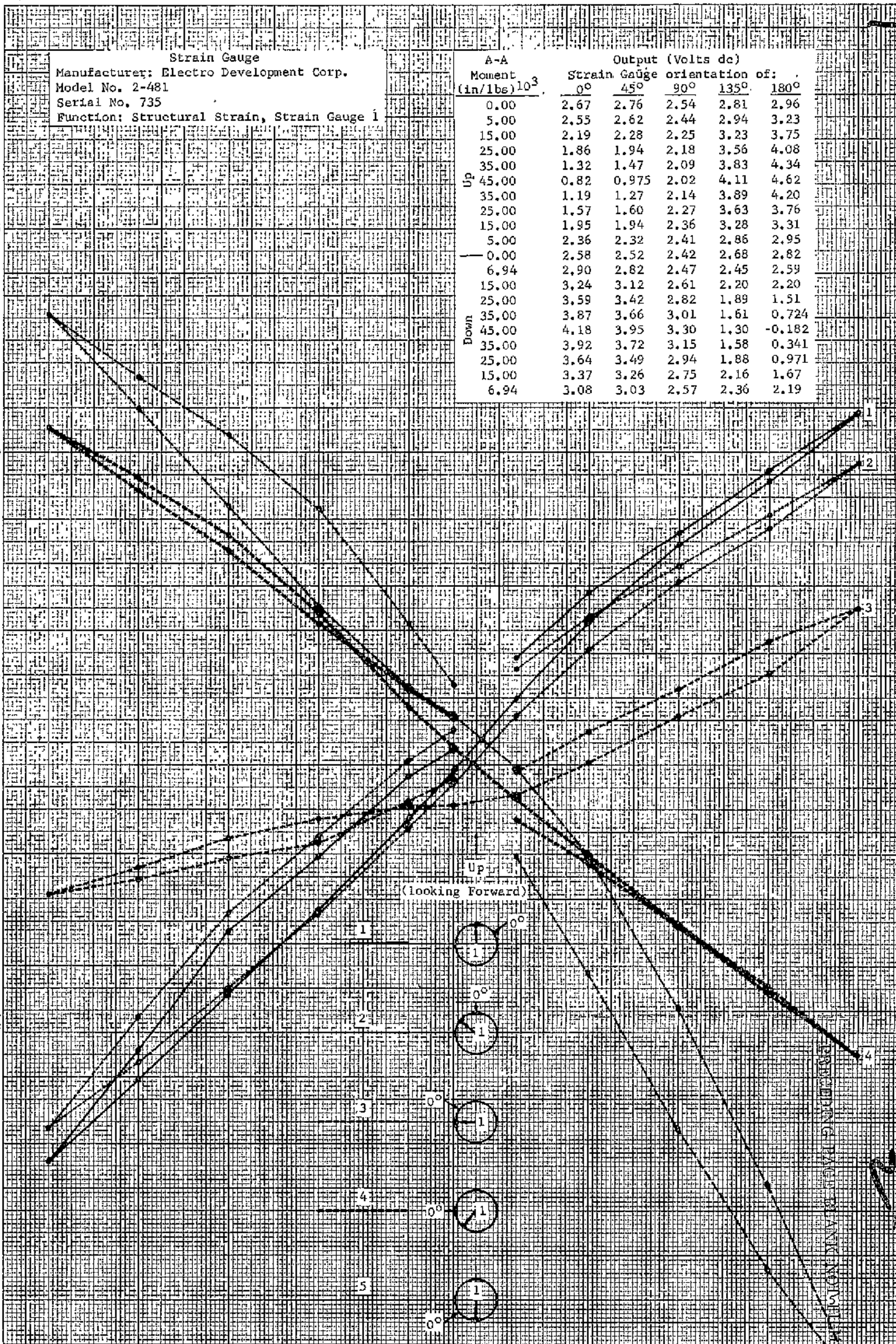


Figure 50. Strain Gauge 1, Calibration at 1 g.



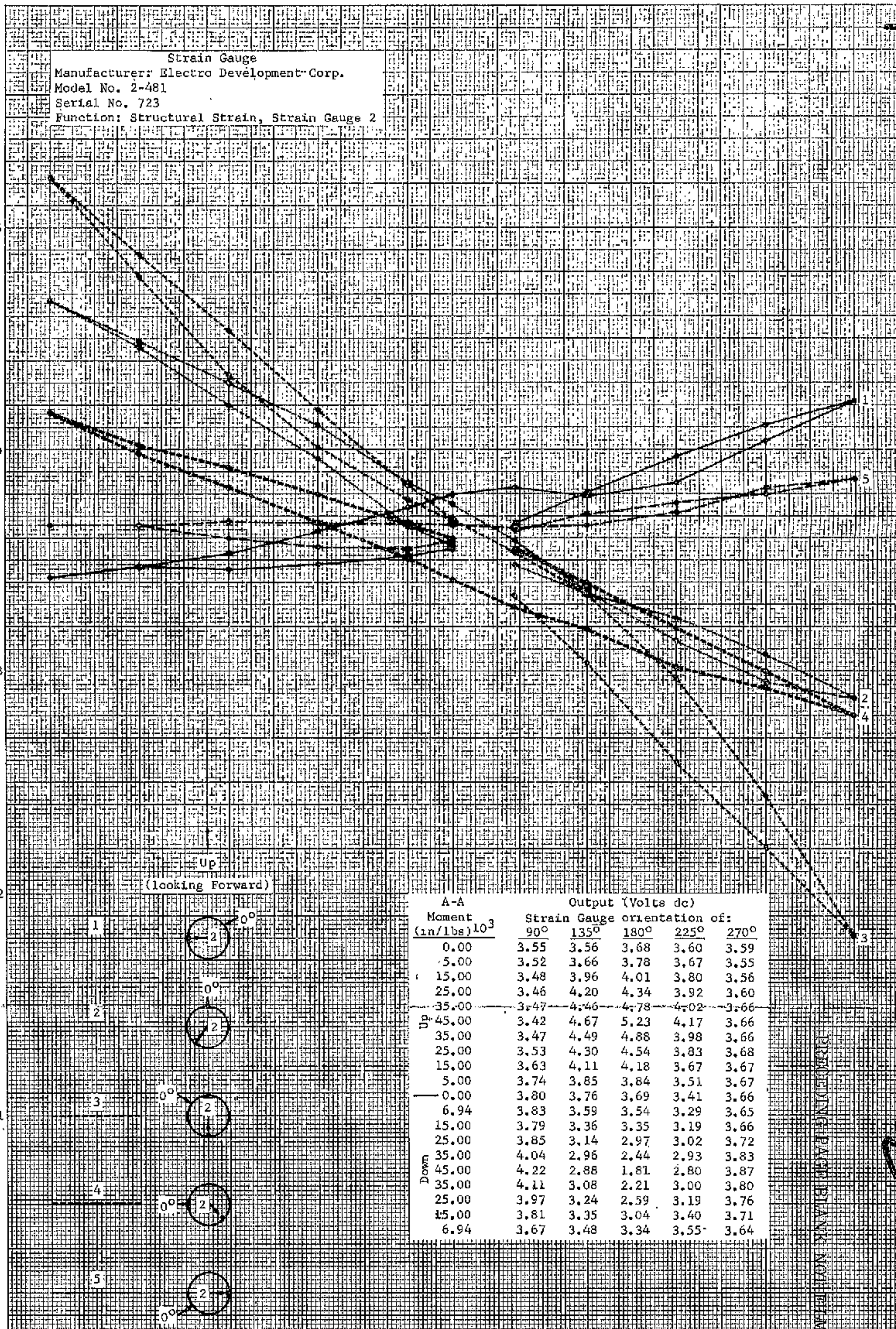
A-A Moment (in/lbs) 10^3	Strain Gauge orientation of: 0°	45°	90°	135°	180°
0.00	3.36	3.31	3.32	3.37	3.43
5.00	3.21	3.19	3.23	3.49	3.71
15.00	2.80	2.86	3.10	3.88	4.19
25.00	2.33	2.54	3.07	4.25	4.54
35.00	1.81	2.09	2.97	4.43	4.79
45.00	1.28	1.69	2.88	4.60	5.13
35.00	1.68	1.98	2.99	4.38	4.71
25.00	2.05	2.29	3.14	4.16	4.30
15.00	2.48	2.63	3.25	3.88	3.88
5.00	2.89	2.97	3.28	3.50	3.43
0.00	3.11	3.13	3.30	3.32	3.29
6.94	3.44	3.42	3.29	3.05	3.11
15.00	3.80	3.76	3.21	2.78	2.81
25.00	4.13	4.08	3.34	2.48	2.25
35.00	4.42	4.29	3.55	2.18	1.34
45.00	4.61	4.52	3.77	1.97	0.333
35.00	4.32	4.27	3.63	2.25	0.864
25.00	4.13	4.06	3.46	2.49	1.55
15.00	3.90	3.85	3.26	2.77	2.24
6.94	3.65	3.61	3.09	2.99	2.76

Figure 51. Strain Gauge 1, Calibration at 8 g



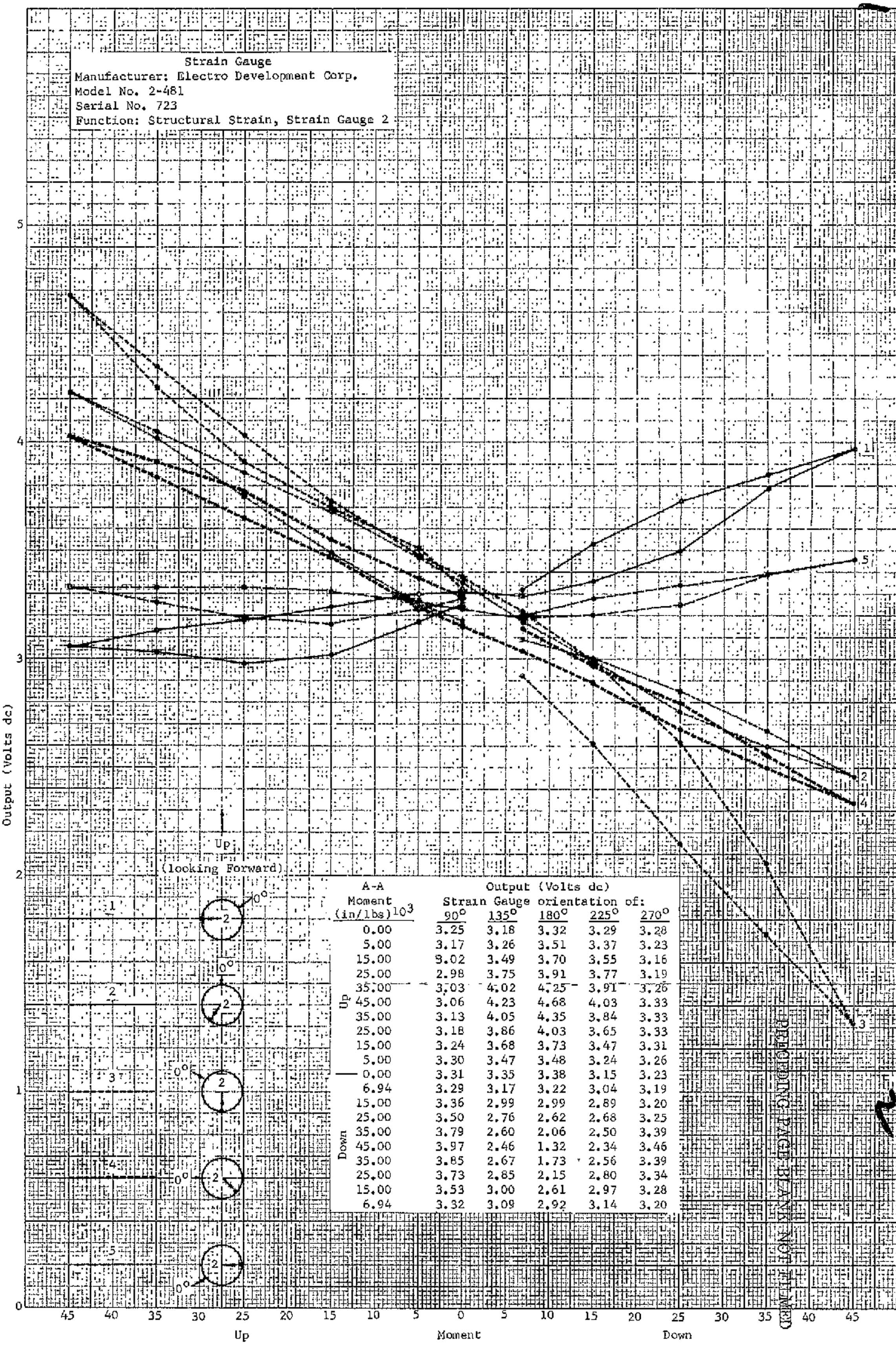
	A-A Moment (in/lbs)10^3	Output (Volts dc) Strain Gauge orientation of: 0°	45°	90°	135°	180°
Up	0.00	2.67	2.76	2.54	2.81	2.96
	5.00	2.55	2.62	2.44	2.94	3.23
	15.00	2.19	2.28	2.25	3.23	3.75
	25.00	1.86	1.94	2.18	3.56	4.08
	35.00	1.32	1.47	2.09	3.83	4.34
	45.00	0.82	0.975	2.02	4.11	4.62
	35.00	1.19	1.27	2.14	3.89	4.20
	25.00	1.57	1.60	2.27	3.63	3.76
	15.00	1.95	1.94	2.36	3.28	3.31
	5.00	2.36	2.32	2.41	2.86	2.95
	0.00	2.58	2.52	2.42	2.68	2.82
Down	6.94	2.90	2.82	2.47	2.45	2.59
	15.00	3.24	3.12	2.61	2.20	2.20
	25.00	3.59	3.42	2.82	1.89	1.51
	35.00	3.87	3.66	3.01	1.61	0.724
	45.00	4.18	3.95	3.30	1.30	-0.182
	35.00	3.92	3.72	3.15	1.58	0.341
	25.00	3.64	3.49	2.94	1.88	0.971
	15.00	3.37	3.26	2.75	2.16	1.67
	6.94	3.08	3.03	2.57	2.36	2.19

Figure 52. Strain Gauge 1, Calibration at 15g



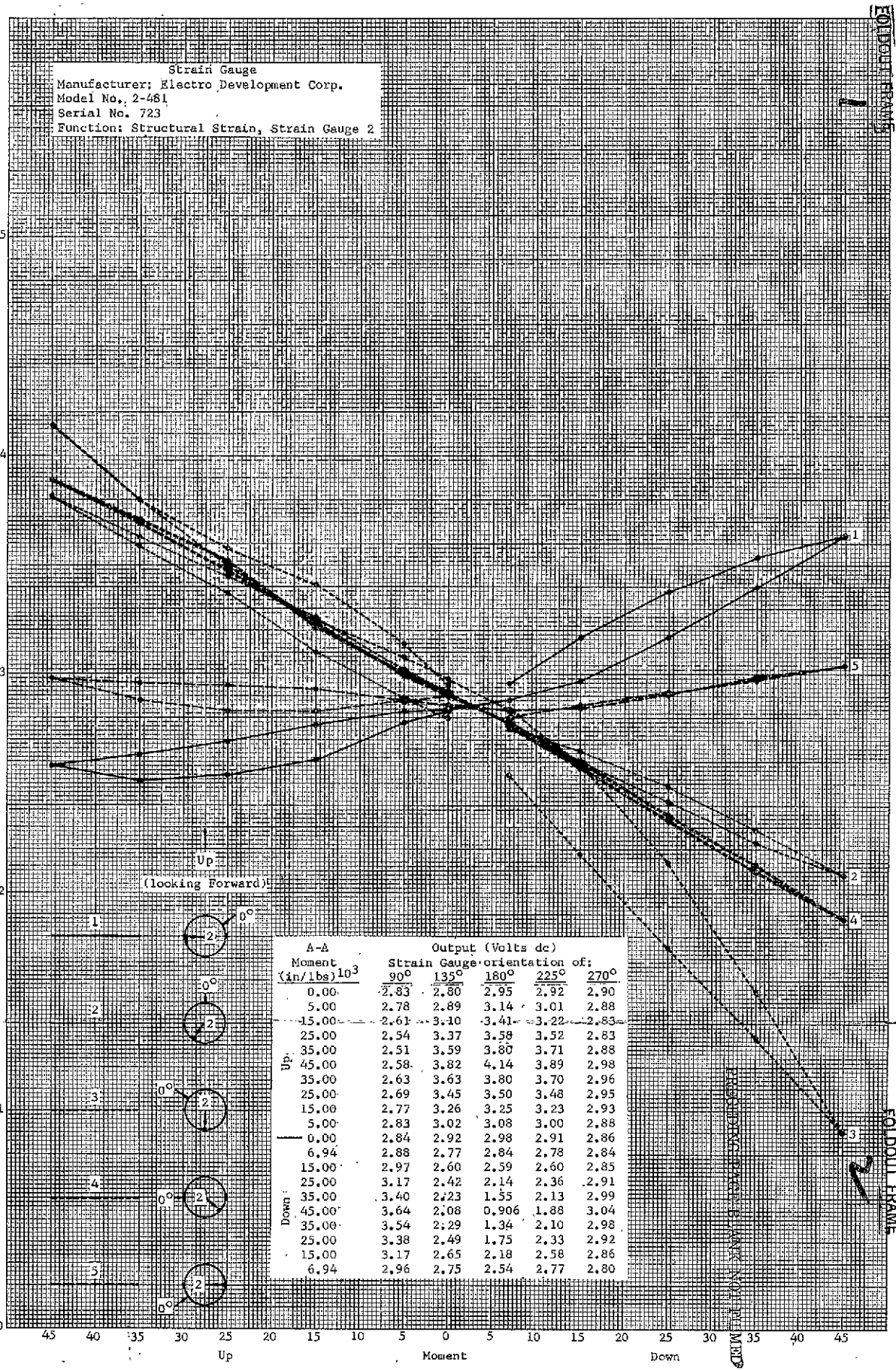
A-A Moment $(in/lbs)10^3$		Output (Volts dc) Strain Gauge orientation of: 90°	135°	180°	225°	270°
	0.00	3.55	3.56	3.68	3.60	3.59
	5.00	3.52	3.66	3.78	3.67	3.55
	15.00	3.48	3.96	4.01	3.80	3.56
	25.00	3.46	4.20	4.34	3.92	3.60
	35.00	3.47	4.46	4.78	4.02	3.66
Up	45.00	3.42	4.67	5.23	4.17	3.66
	35.00	3.47	4.49	4.88	3.98	3.66
	25.00	3.53	4.30	4.54	3.83	3.68
	15.00	3.63	4.11	4.18	3.67	3.67
	5.00	3.74	3.85	3.84	3.51	3.67
	0.00	3.80	3.76	3.69	3.41	3.66
	6.94	3.83	3.59	3.54	3.29	3.65
	15.00	3.79	3.36	3.35	3.19	3.66
	25.00	3.85	3.14	2.97	3.02	3.72
	35.00	4.04	2.96	2.44	2.93	3.83
Down	45.00	4.22	2.88	1.81	2.80	3.87
	35.00	4.11	3.08	2.21	3.00	3.80
	25.00	3.97	3.24	2.59	3.19	3.76
	15.00	3.81	3.35	3.04	3.40	3.71
	6.94	3.67	3.48	3.34	3.55	3.64

Figure 53. Strain Gauge 2, Calibration at 1g



A-A Moment (in/lbs)10^3		Output (Volts dc) Strain Gauge orientation of: 90°	135°	180°	225°	270°
	0.00	3.25	3.18	3.32	3.29	3.28
	5.00	3.17	3.26	3.51	3.37	3.23
	15.00	3.02	3.49	3.70	3.55	3.16
	25.00	2.98	3.75	3.91	3.77	3.19
Up	35.00	3.03	4.02	4.25	3.91	3.26
	45.00	3.06	4.23	4.68	4.03	3.33
	35.00	3.13	4.05	4.35	3.84	3.33
	25.00	3.18	3.86	4.03	3.65	3.33
	15.00	3.24	3.68	3.73	3.47	3.31
	5.00	3.30	3.47	3.48	3.24	3.26
	0.00	3.31	3.35	3.38	3.15	3.23
	6.94	3.29	3.17	3.22	3.04	3.19
	15.00	3.36	2.99	2.99	2.89	3.20
	25.00	3.50	2.76	2.62	2.68	3.25
Down	35.00	3.79	2.60	2.06	2.50	3.39
	45.00	3.97	2.46	1.32	2.34	3.46
	35.00	3.85	2.67	1.73	2.56	3.39
	25.00	3.73	2.85	2.15	2.80	3.34
	15.00	3.53	3.00	2.61	2.97	3.28
	6.94	3.32	3.09	2.92	3.14	3.20

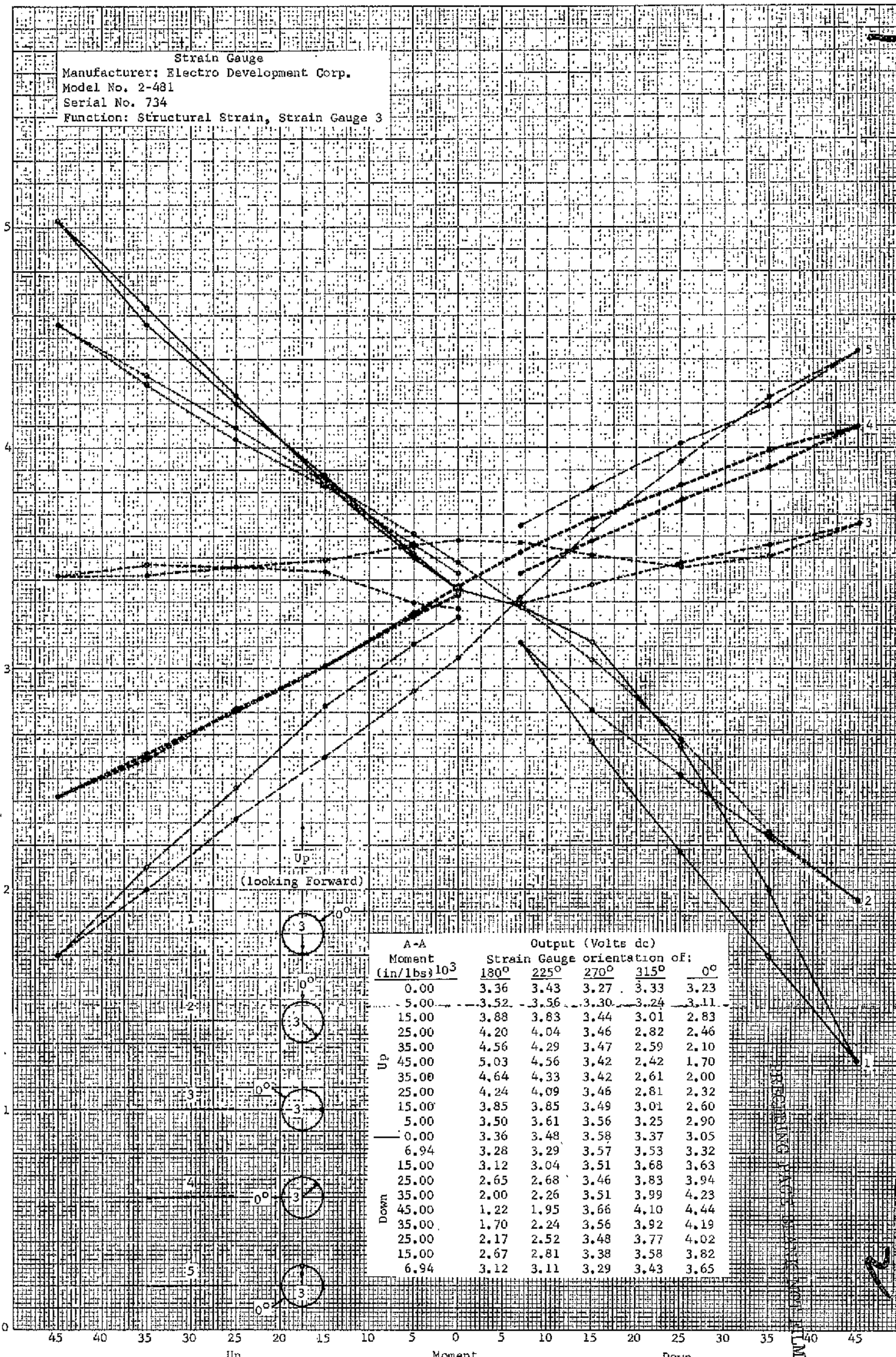
Figure 54. Strain Gauge 2, Calibration at 8 g



A-A Moment (in/lbs) 10^3	Output (Volts dc) Strain Gauge orientation of: 90°	135°	180°	225°	270°
0.00	2.83	2.80	2.95	2.92	2.90
5.00	2.78	2.89	3.14	3.01	2.88
15.00	2.61	3.10	3.41	3.22	2.83
25.00	2.54	3.37	3.58	3.52	2.83
35.00	2.51	3.59	3.80	3.71	2.88
45.00	2.58	3.82	4.14	3.89	2.98
35.00	2.63	3.63	3.80	3.70	2.96
25.00	2.69	3.45	3.50	3.48	2.95
15.00	2.77	3.26	3.25	3.23	2.93
5.00	2.83	3.02	3.08	3.00	2.88
0.00	2.84	2.92	2.98	2.91	2.86
6.94	2.88	2.77	2.84	2.78	2.84
15.00	2.97	2.60	2.59	2.60	2.85
25.00	3.17	2.42	2.14	2.36	2.91
35.00	3.40	2.23	1.55	2.13	2.99
45.00	3.64	2.08	0.906	1.88	3.04
35.00	3.54	2.29	1.34	2.10	2.98
25.00	3.38	2.49	1.75	2.33	2.92
15.00	3.17	2.65	2.18	2.58	2.86
6.94	2.96	2.75	2.54	2.77	2.80

Figure 55. Strain Gauge 2, Calibration at 15g

FOLDOUT FRAME 1



	A-A Moment (in/lbs) 10^3	Output (Volts dc) Strain Gauge orientation of: 180°	225°	270°	315°	0°
	0.00	3.36	3.43	3.27	3.33	3.23
	5.00	3.52	3.56	3.30	3.24	3.11
Up	15.00	3.88	3.83	3.44	3.01	2.83
	25.00	4.20	4.04	3.46	2.82	2.46
	35.00	4.56	4.29	3.47	2.59	2.10
	45.00	5.03	4.56	3.42	2.42	1.70
	35.00	4.64	4.33	3.42	2.61	2.00
	25.00	4.24	4.09	3.46	2.81	2.32
	15.00	3.85	3.85	3.49	3.01	2.60
	5.00	3.50	3.61	3.56	3.25	2.90
	0.00	3.36	3.48	3.58	3.37	3.05
Down	6.94	3.28	3.29	3.57	3.53	3.32
	15.00	3.12	3.04	3.51	3.68	3.63
	25.00	2.65	2.68	3.46	3.83	3.94
	35.00	2.00	2.26	3.51	3.99	4.23
	45.00	1.22	1.95	3.66	4.10	4.44
	35.00	1.70	2.24	3.56	3.92	4.19
	25.00	2.17	2.52	3.48	3.77	4.02
	15.00	2.67	2.81	3.38	3.58	3.82
	6.94	3.12	3.11	3.29	3.43	3.65

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FOLDOUT FRAME 2

Figure 56. Strain Gauge 3, Calibration at 1g

FOLDOUT FRAME 1

FOLDOUT FRAME 2

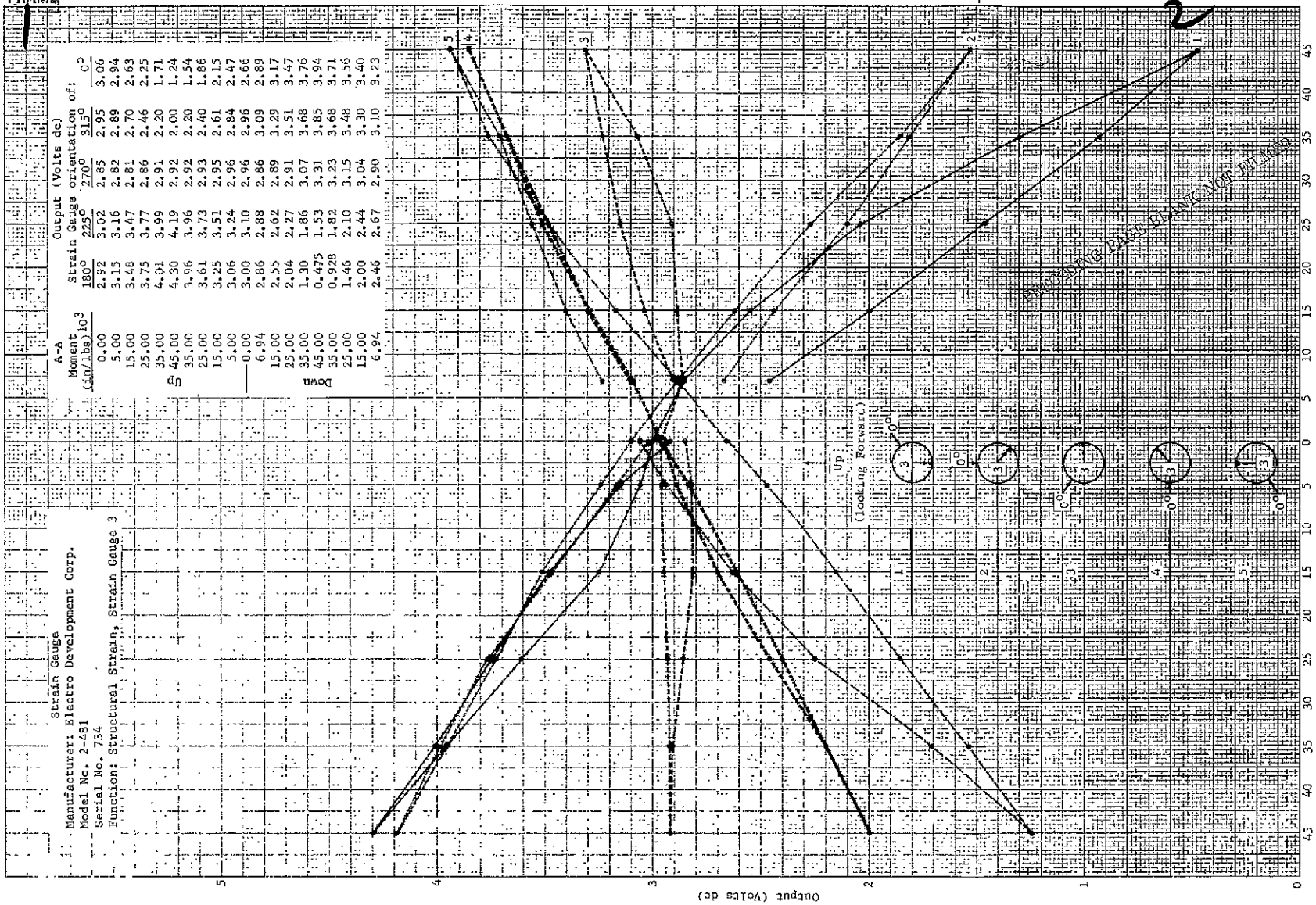
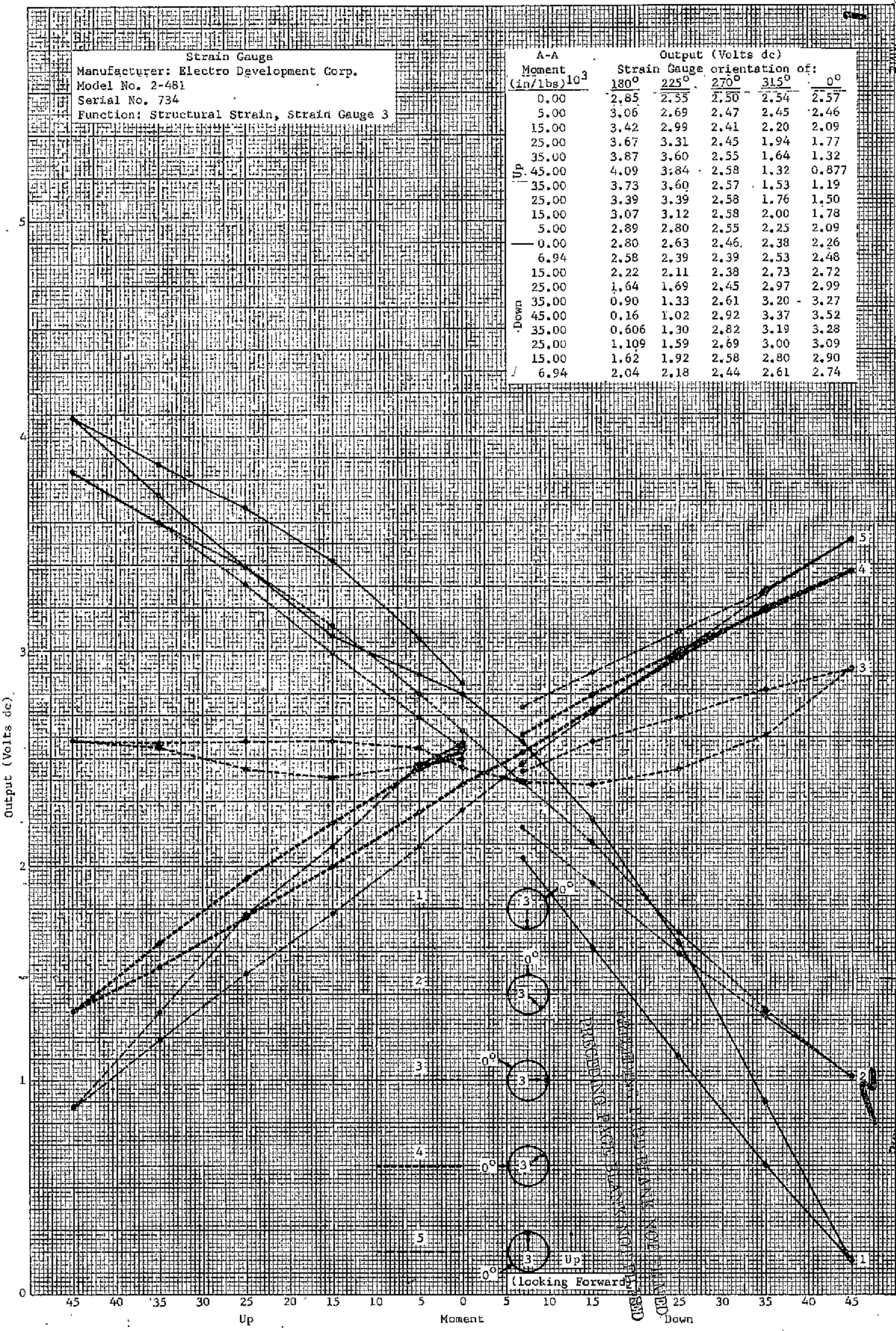


Figure 57. Strain Gauge 3, Calibration at 8 g

FOLDOUT FRAME



A-A Moment (in/lbs)10^3		Output (Volts dc) Strain Gauge orientation of: 180°	225°	270°	315°	0°
	0.00	2.85	2.55	2.50	2.54	2.57
Up	5.00	3.06	2.69	2.47	2.45	2.46
	15.00	3.42	2.99	2.41	2.20	2.09
	25.00	3.67	3.31	2.45	1.94	1.77
	35.00	3.87	3.60	2.55	1.64	1.32
	45.00	4.09	3.84	2.58	1.32	0.877
	35.00	3.73	3.60	2.57	1.53	1.19
	25.00	3.39	3.39	2.58	1.76	1.50
	15.00	3.07	3.12	2.58	2.00	1.78
	5.00	2.89	2.80	2.55	2.25	2.09
	0.00	2.80	2.63	2.46	2.38	2.26
Down	6.94	2.58	2.39	2.39	2.53	2.48
	15.00	2.22	2.11	2.38	2.73	2.72
	25.00	1.64	1.69	2.45	2.97	2.99
	35.00	0.90	1.33	2.61	3.20	3.27
	45.00	0.16	1.02	2.92	3.37	3.52
	35.00	0.606	1.30	2.82	3.19	3.28
	25.00	1.109	1.59	2.69	3.00	3.09
	15.00	1.62	1.92	2.58	2.80	2.90
	6.94	2.04	2.18	2.44	2.61	2.74

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Figure 58. Strain Gauge 3, Calibration at 15g.

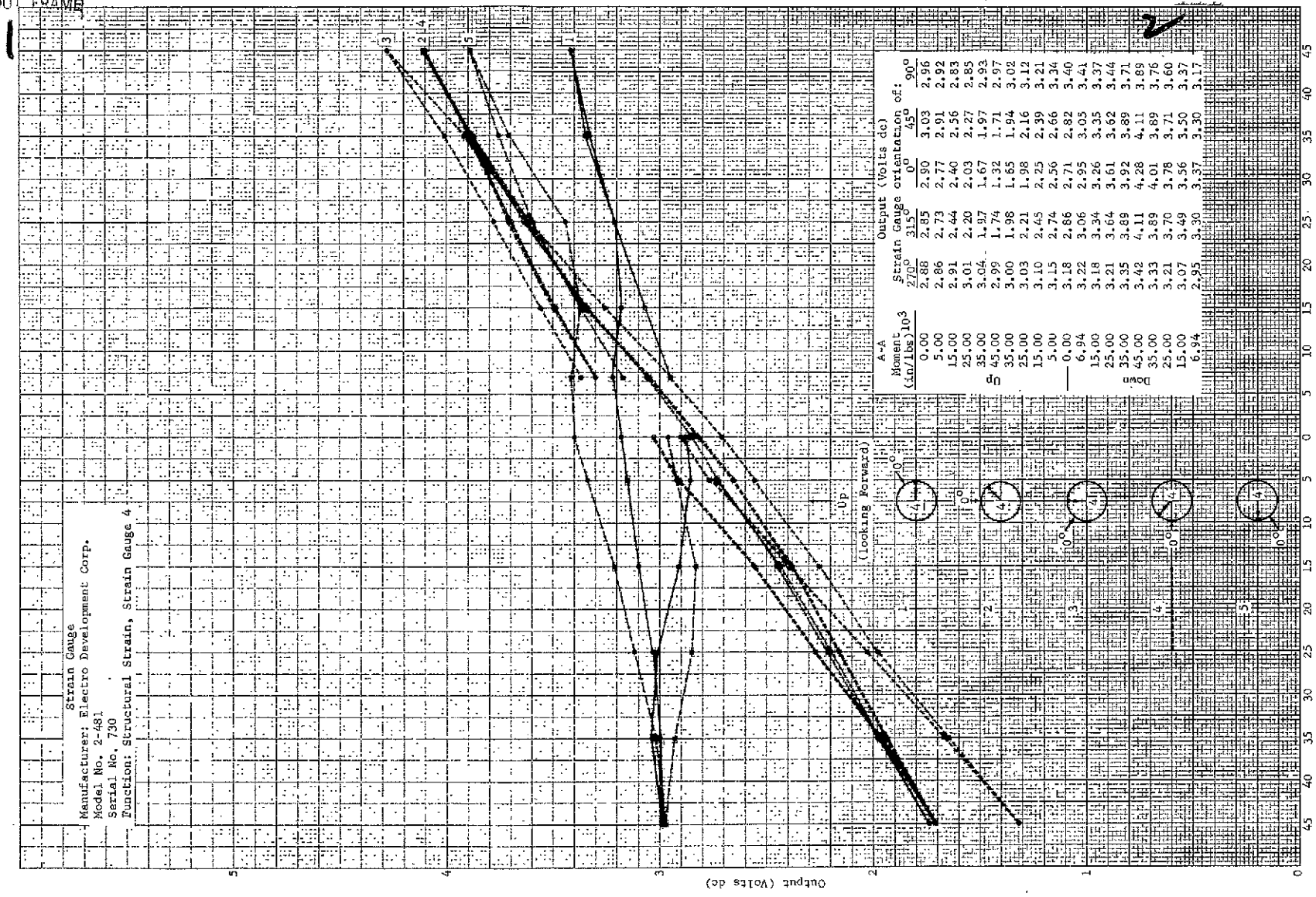
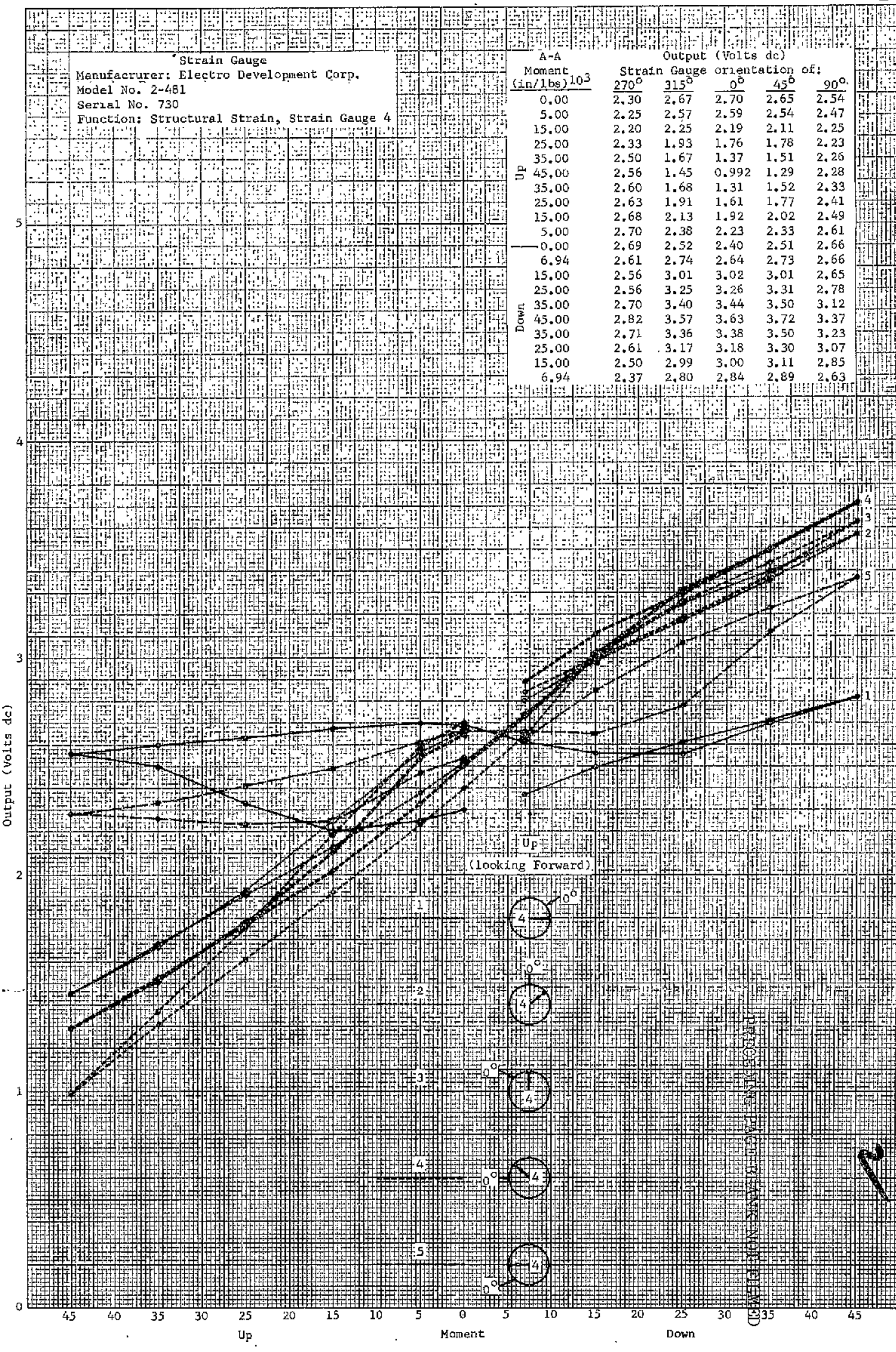
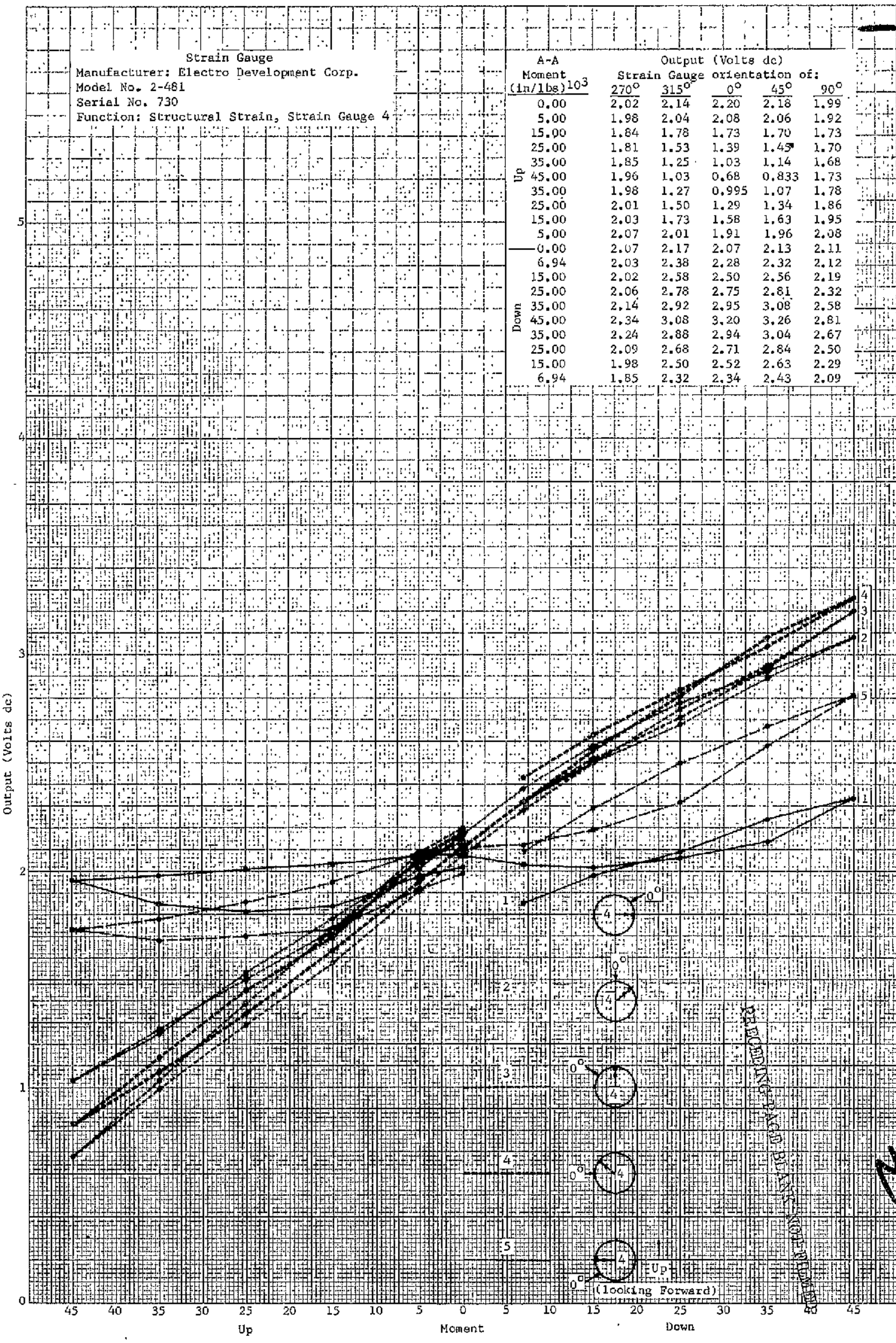


Figure 59. Strain Gauge 4, Calibration at 1 g



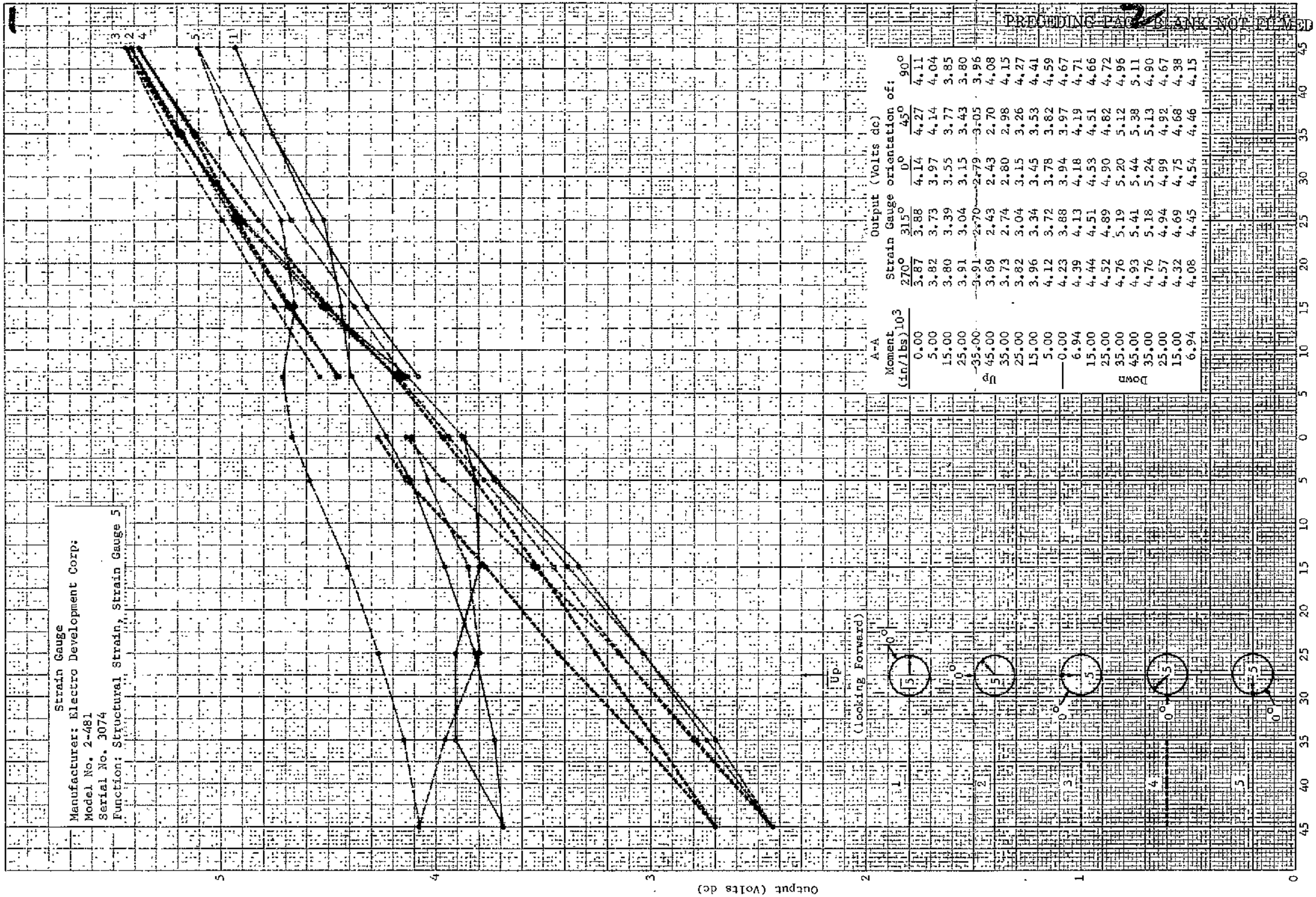
A-A Moment (in/lbs)10^3		Strain Gauge orientation of: 270°	315°	0°	45°	90°
Up	0.00	2.30	2.67	2.70	2.65	2.54
	5.00	2.25	2.57	2.59	2.54	2.47
	15.00	2.20	2.25	2.19	2.11	2.25
	25.00	2.33	1.93	1.76	1.78	2.23
	35.00	2.50	1.67	1.37	1.51	2.26
	45.00	2.56	1.45	0.992	1.29	2.28
	35.00	2.60	1.68	1.31	1.52	2.33
	25.00	2.63	1.91	1.61	1.77	2.41
	15.00	2.68	2.13	1.92	2.02	2.49
	5.00	2.70	2.38	2.23	2.33	2.61
	0.00	2.69	2.52	2.40	2.51	2.66
Down	6.94	2.61	2.74	2.64	2.73	2.66
	15.00	2.56	3.01	3.02	3.01	2.65
	25.00	2.56	3.25	3.26	3.31	2.78
	35.00	2.70	3.40	3.44	3.50	3.12
	45.00	2.82	3.57	3.63	3.72	3.37
	35.00	2.71	3.36	3.38	3.50	3.23
	25.00	2.61	3.17	3.18	3.30	3.07
	15.00	2.50	2.99	3.00	3.11	2.85
	6.94	2.37	2.80	2.84	2.89	2.63

Figure 60. Strain Gauge 4, Calibration at 8g



	A-A Moment (in/lbs)10^3	Output (Volts dc) Strain Gauge orientation of: 270°	315°	0°	45°	90°
Up	0.00	2.02	2.14	2.20	2.18	1.99
	5.00	1.98	2.04	2.08	2.06	1.92
	15.00	1.84	1.78	1.73	1.70	1.73
	25.00	1.81	1.53	1.39	1.45	1.70
	35.00	1.85	1.25	1.03	1.14	1.68
	45.00	1.96	1.03	0.68	0.833	1.73
	35.00	1.98	1.27	0.995	1.07	1.78
	25.00	2.01	1.50	1.29	1.34	1.86
	15.00	2.03	1.73	1.58	1.63	1.95
	5.00	2.07	2.01	1.91	1.96	2.08
Down	0.00	2.07	2.17	2.07	2.13	2.11
	6.94	2.03	2.38	2.28	2.32	2.12
	15.00	2.02	2.58	2.50	2.56	2.19
	25.00	2.06	2.78	2.75	2.81	2.32
	35.00	2.14	2.92	2.95	3.08	2.58
	45.00	2.34	3.08	3.20	3.26	2.81
	35.00	2.24	2.88	2.94	3.04	2.67
	25.00	2.09	2.68	2.71	2.84	2.50
	15.00	1.98	2.50	2.52	2.63	2.29
	6.94	1.85	2.32	2.34	2.43	2.09

Figure 61. Strain Gauge 4, Calibration at 15g



A-A Moment (in/lbs)10^3		Strain Gauge Output (Volts dc) orientation of: 270°	315°	0°	45°	90°
	0.00	3.87	3.88	4.14	4.27	4.11
	5.00	3.82	3.73	3.97	4.14	4.04
	15.00	3.80	3.39	3.55	3.77	3.85
	25.00	3.91	3.04	3.15	3.43	3.80
Up	35.00	3.91	2.70	2.79	3.05	3.96
	45.00	3.69	2.43	2.43	2.70	4.08
	35.00	3.73	2.74	2.80	2.98	4.15
	25.00	3.82	3.04	3.15	3.26	4.27
	15.00	3.96	3.34	3.45	3.53	4.41
	5.00	4.12	3.72	3.78	3.82	4.59
	0.00	4.23	3.88	3.94	3.97	4.67
	6.94	4.39	4.13	4.18	4.19	4.71
	15.00	4.44	4.51	4.53	4.51	4.66
	25.00	4.52	4.89	4.90	4.82	4.72
Down	35.00	4.76	5.19	5.20	5.12	4.96
	45.00	4.93	5.41	5.44	5.38	5.11
	35.00	4.76	5.18	5.24	5.13	4.90
	25.00	4.57	4.94	4.99	4.92	4.67
	15.00	4.32	4.69	4.75	4.68	4.38
	6.94	4.08	4.45	4.54	4.46	4.15

Figure 62. Strain Gauge 5, Calibration at 1g

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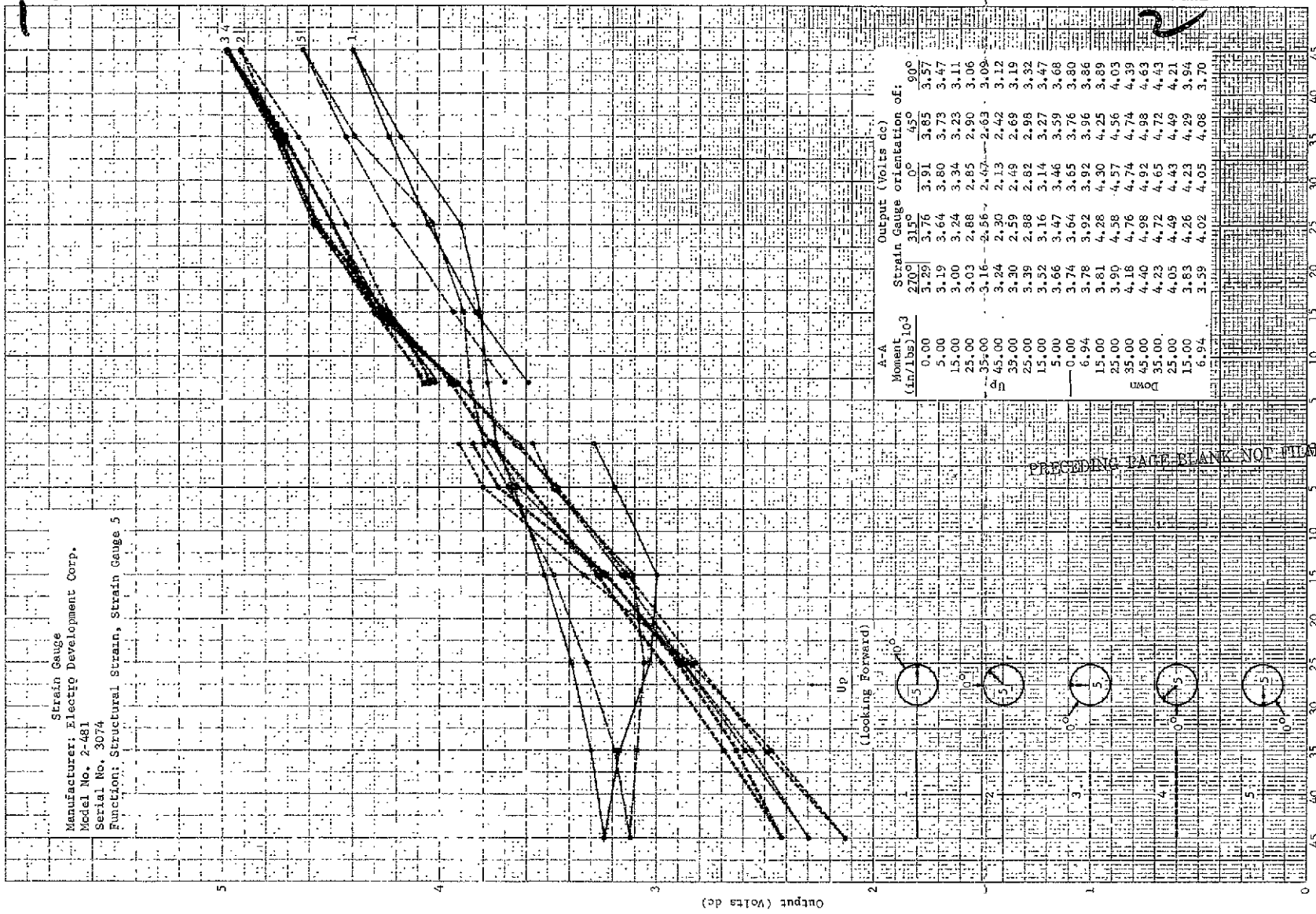

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Figure 63. Strain Gauge 5, Calibration at 8 g

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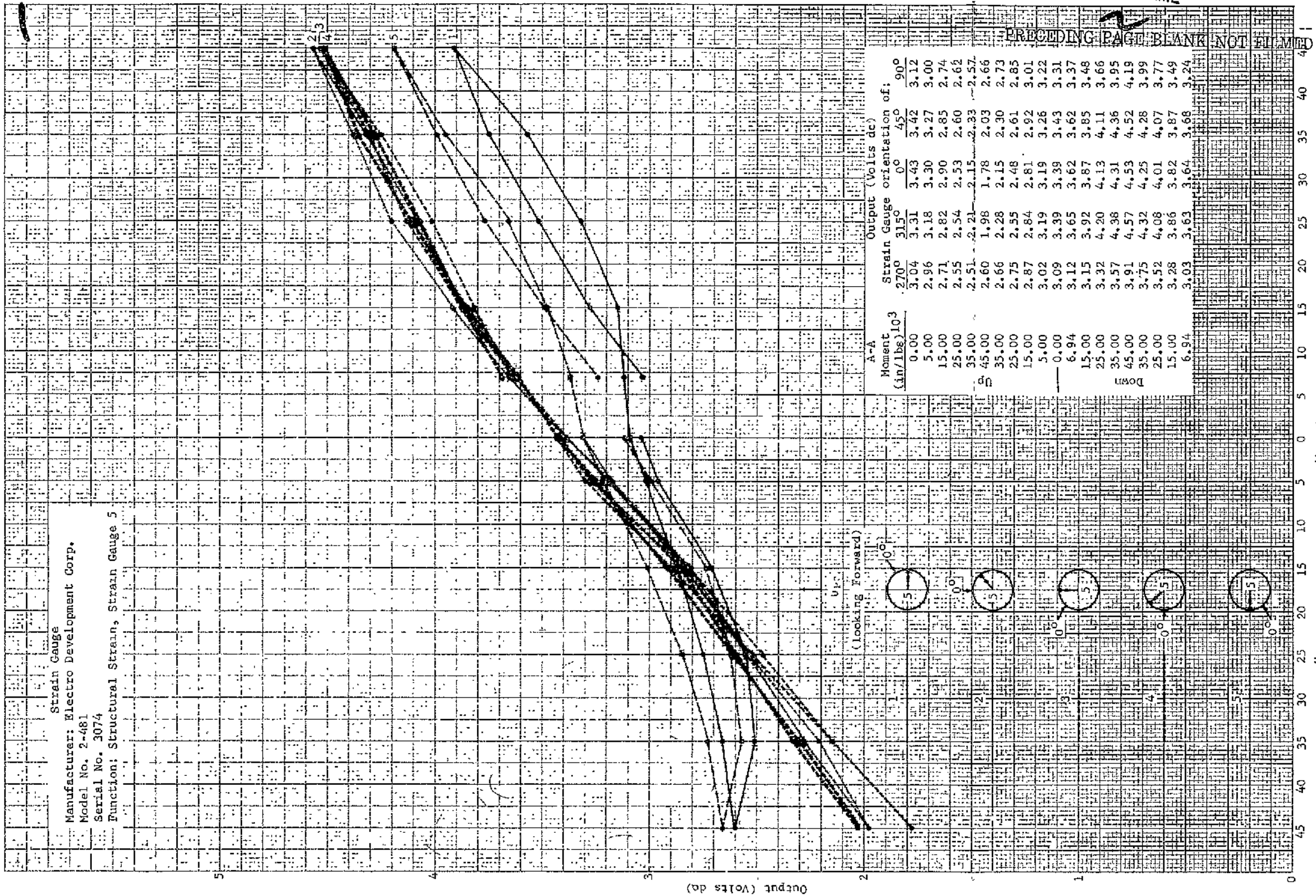


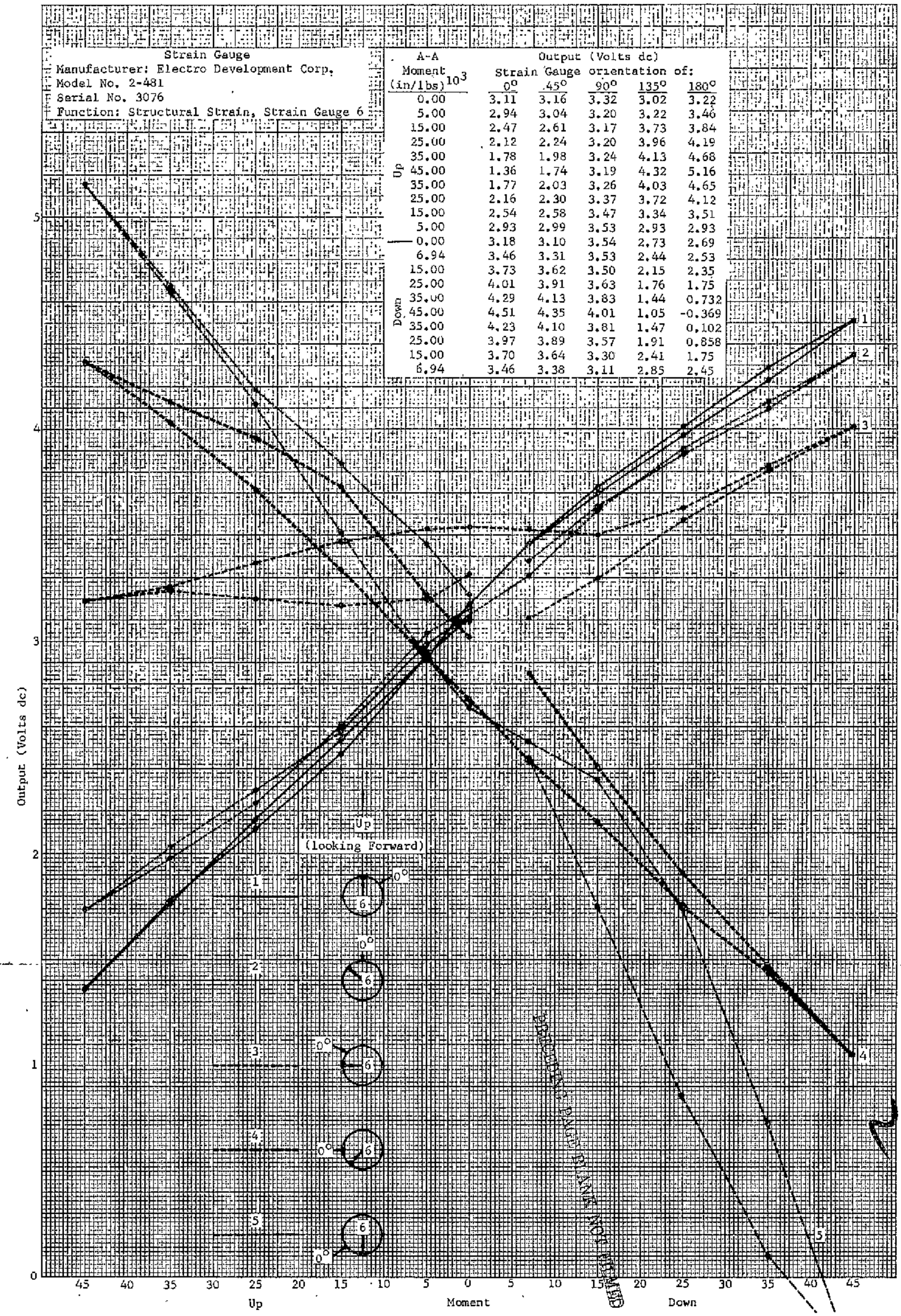
	A-A Moment (in/lbs)10^3	Output (Volts dc) Strain Gauge orientation of: 270°	315°	0°	45°	90°
	0.00	3.04	3.31	3.43	3.42	3.12
	5.00	2.96	3.18	3.30	3.27	3.00
	15.00	2.71	2.82	2.90	2.85	2.74
	25.00	2.55	2.54	2.53	2.60	2.62
	35.00	2.51	2.21	2.15	2.33	2.57
Up	45.00	2.60	1.98	1.78	2.03	2.66
	35.00	2.66	2.28	2.15	2.30	2.73
	25.00	2.75	2.55	2.48	2.61	2.85
	15.00	2.87	2.84	2.81	2.92	3.01
	5.00	3.02	3.19	3.19	3.26	3.22
	0.00	3.09	3.39	3.39	3.43	3.31
	6.94	3.12	3.65	3.62	3.62	3.37
	15.00	3.15	3.92	3.87	3.85	3.48
	25.00	3.32	4.20	4.13	4.11	3.66
	35.00	3.57	4.38	4.31	4.36	3.95
Down	45.00	3.91	4.57	4.53	4.52	4.19
	35.00	3.75	4.32	4.25	4.28	3.99
	25.00	3.52	4.08	4.01	4.07	3.77
	15.00	3.28	3.86	3.82	3.87	3.49
	6.94	3.03	3.63	3.64	3.68	3.24

Figure 64. Strain Gauge 5, Calibration at 15g

FOLDOUT FRAME

Strain Gauge
Manufacturer: Electro Development Corp.
Model No. 2-481
Serial No. 3076
Function: Structural Strain, Strain Gauge 6

	A-A Moment (in/lbs)10^3	Output (Volts dc) Strain Gauge orientation of: 0°	45°	90°	135°	180°
	0.00	3.11	3.16	3.32	3.02	3.22
Up	5.00	2.94	3.04	3.20	3.22	3.46
	15.00	2.47	2.61	3.17	3.73	3.84
	25.00	2.12	2.24	3.20	3.96	4.19
	35.00	1.78	1.98	3.24	4.13	4.68
	45.00	1.36	1.74	3.19	4.32	5.16
	35.00	1.77	2.03	3.26	4.03	4.65
	25.00	2.16	2.30	3.37	3.72	4.12
	15.00	2.54	2.58	3.47	3.34	3.51
	5.00	2.93	2.99	3.53	2.93	2.93
	0.00	3.18	3.10	3.54	2.73	2.69
Down	6.94	3.46	3.31	3.53	2.44	2.53
	15.00	3.73	3.62	3.50	2.15	2.35
	25.00	4.01	3.91	3.63	1.76	1.75
	35.00	4.29	4.13	3.83	1.44	0.732
	45.00	4.51	4.35	4.01	1.05	-0.369
	35.00	4.23	4.10	3.81	1.47	0.102
	25.00	3.97	3.89	3.57	1.91	0.858
	15.00	3.70	3.64	3.30	2.41	1.75
	6.94	3.46	3.38	3.11	2.85	2.45



FOLDOUT FRAME

Figure 65. Strain Gauge 6, Calibration at 1g

FOLDOUT FRAME

FOLDOUT FRAME

Strain Gauge
Manufacturer: Electro Development Corp.
Model No. 2-481
Serial No. 3076
Function: Structural Strain, Strain Gauge 6

A-A

	Moment (In/lbs) $\times 10^3$	Output (Volts dc) Strain Gauge orientation of: 0°	45°	90°	135°	180°
	0.00	2.72	2.52	2.59	2.78	2.68
	5.00	2.56	2.41	2.47	2.98	3.00
	15.00	2.13	2.16	2.33	3.48	3.56
	25.00	1.68	1.92	2.33	3.88	3.92
	35.00	1.26	1.54	2.20	4.10	4.25
	45.00	0.755	1.20	2.12	4.27	4.64
	35.00	1.18	1.48	2.22	3.99	4.16
	25.00	1.53	1.78	2.36	3.86	3.62
	15.00	1.95	2.08	2.51	3.24	3.07
	5.00	2.38	2.39	2.57	2.71	2.57
	0.00	2.61	2.56	2.58	2.48	2.47
	6.94	2.97	2.85	2.49	2.20	2.32
	15.00	3.32	3.19	2.54	1.91	2.01
	25.00	3.61	3.48	2.70	1.52	1.36
	35.00	3.85	3.67	3.02	1.09	0.236
	45.00	4.03	3.90	3.40	0.663	-0.626
	35.00	3.75	3.67	3.21	1.10	-0.374
	25.00	3.51	3.45	2.98	1.48	0.361
	15.00	3.26	3.21	2.70	1.94	1.21
	6.94	2.97	2.93	2.47	2.32	1.89

Up / Down

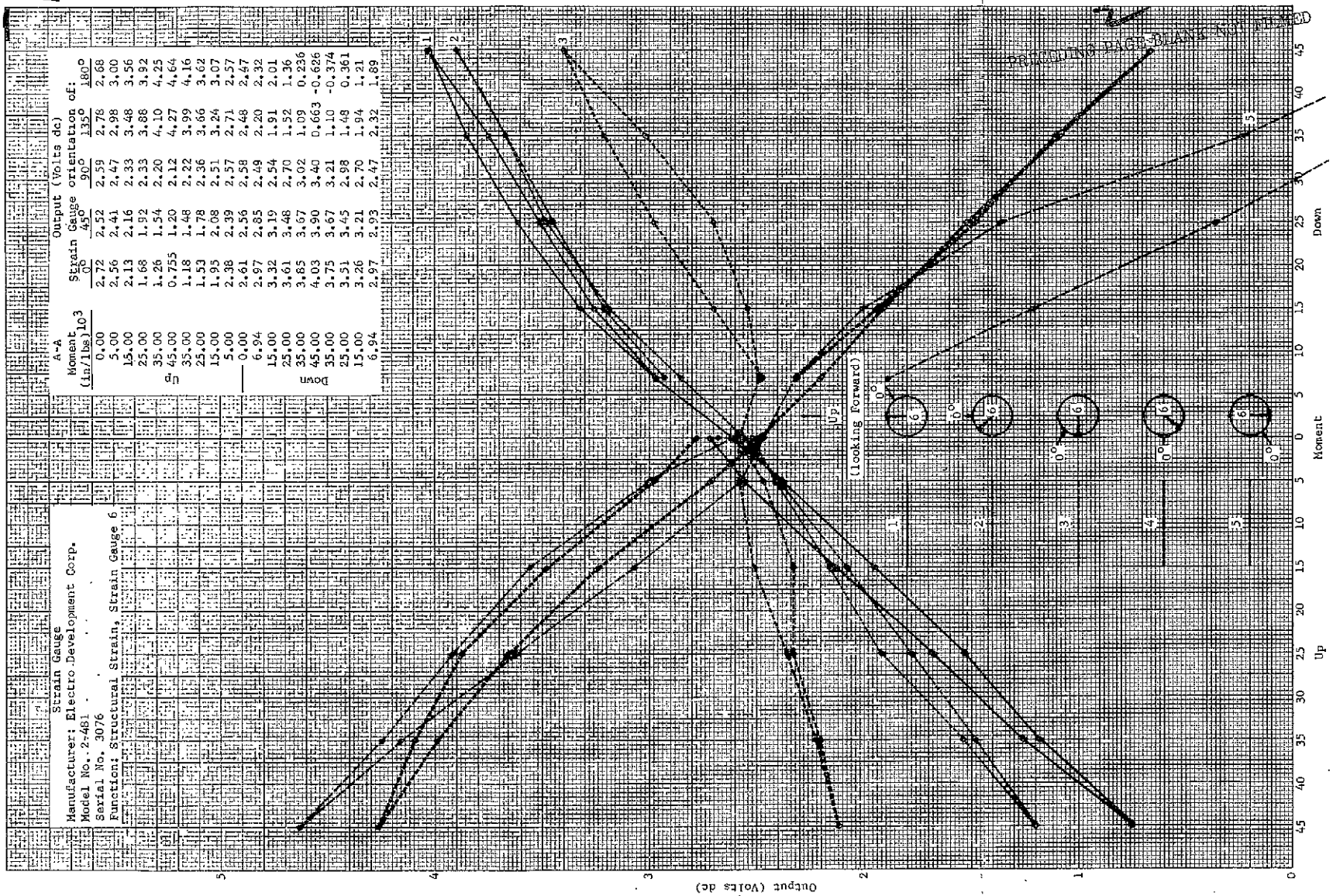
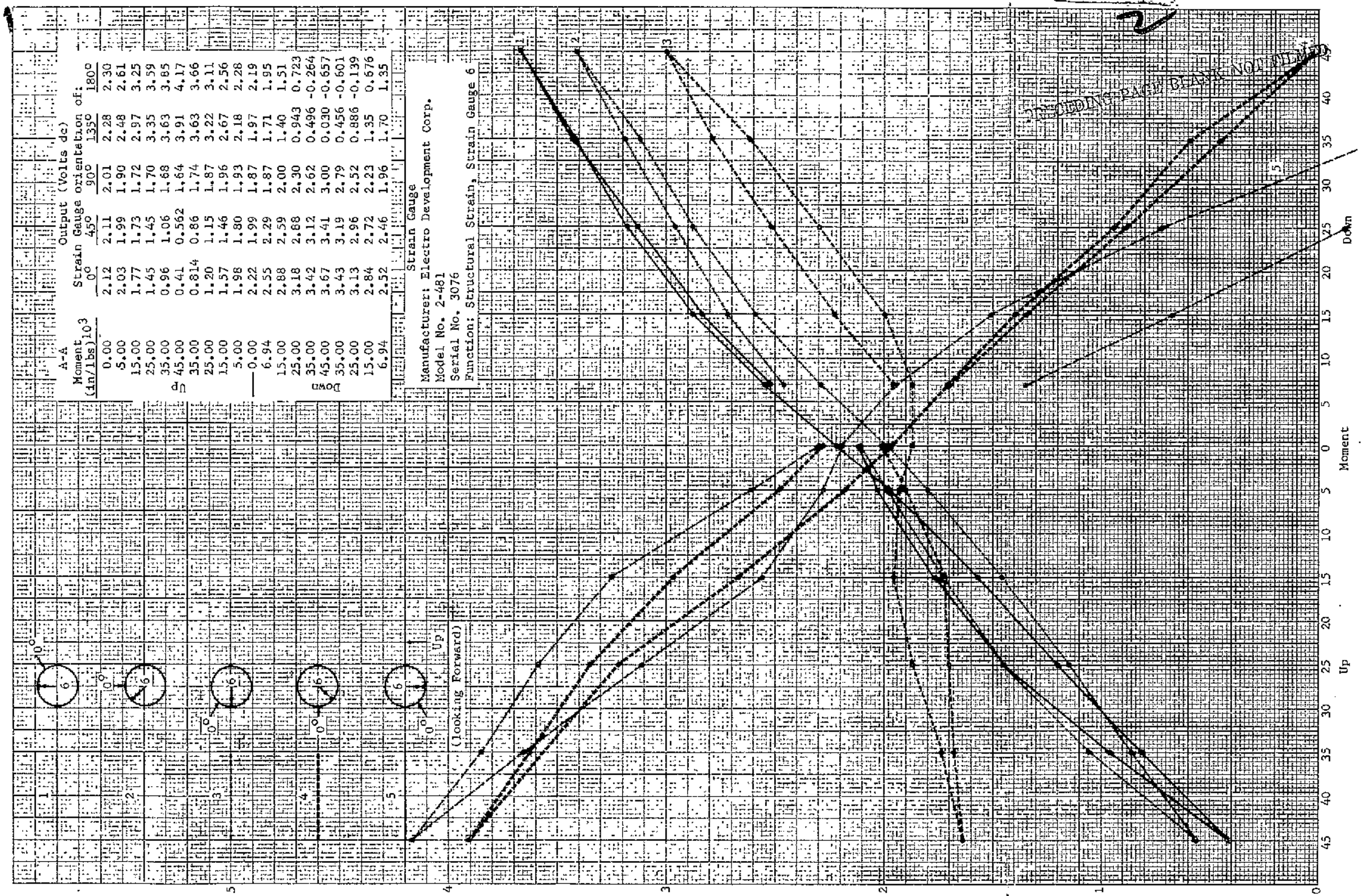


Figure 66. Strain Gauge 6, Calibration at 8 g

FOLDOUT FRAME

FOLDOUT FRAME



A-A

Moment (in/lbs)10^3	Strain Gauge orientation of: 0°	45°	90°	135°	180°
0.00	2.12	2.11	2.01	2.28	2.30
5.00	2.03	1.99	1.90	2.48	2.61
15.00	1.77	1.73	1.72	2.97	3.25
25.00	1.45	1.45	1.70	3.35	3.59
35.00	0.96	1.06	1.68	3.63	3.85
45.00	0.41	0.562	1.64	3.91	4.17
35.00	0.814	0.86	1.74	3.63	3.66
25.00	1.20	1.15	1.87	3.22	3.11
15.00	1.57	1.46	1.96	2.67	2.56
5.00	1.98	1.80	1.93	2.18	2.28
0.00	2.22	1.99	1.87	1.97	2.19
6.94	2.55	2.29	1.87	1.71	1.95
15.00	2.88	2.59	2.00	1.40	1.51
25.00	3.18	2.88	2.30	0.943	0.723
35.00	3.42	3.12	2.62	0.496	-0.264
45.00	3.67	3.41	3.00	0.030	-0.657
35.00	3.43	3.19	2.79	0.456	-0.601
25.00	3.13	2.96	2.52	0.886	-0.139
15.00	2.84	2.72	2.23	1.35	0.676
6.94	2.52	2.46	1.96	1.70	1.35

(Rows 0.00–5.00 of the first half: Up; rows 0.00–6.94 of the second half: Down)

Strain Gauge
Manufacturer: Electro Development Corp.
Model No. 2-481
Serial No. 3076
Function: Structural Strain, Strain Gauge 6

Figure 67. Strain Gauge 6, Calibration at 15g

FOLDOUT FRAME

FOLDOUT FRAME

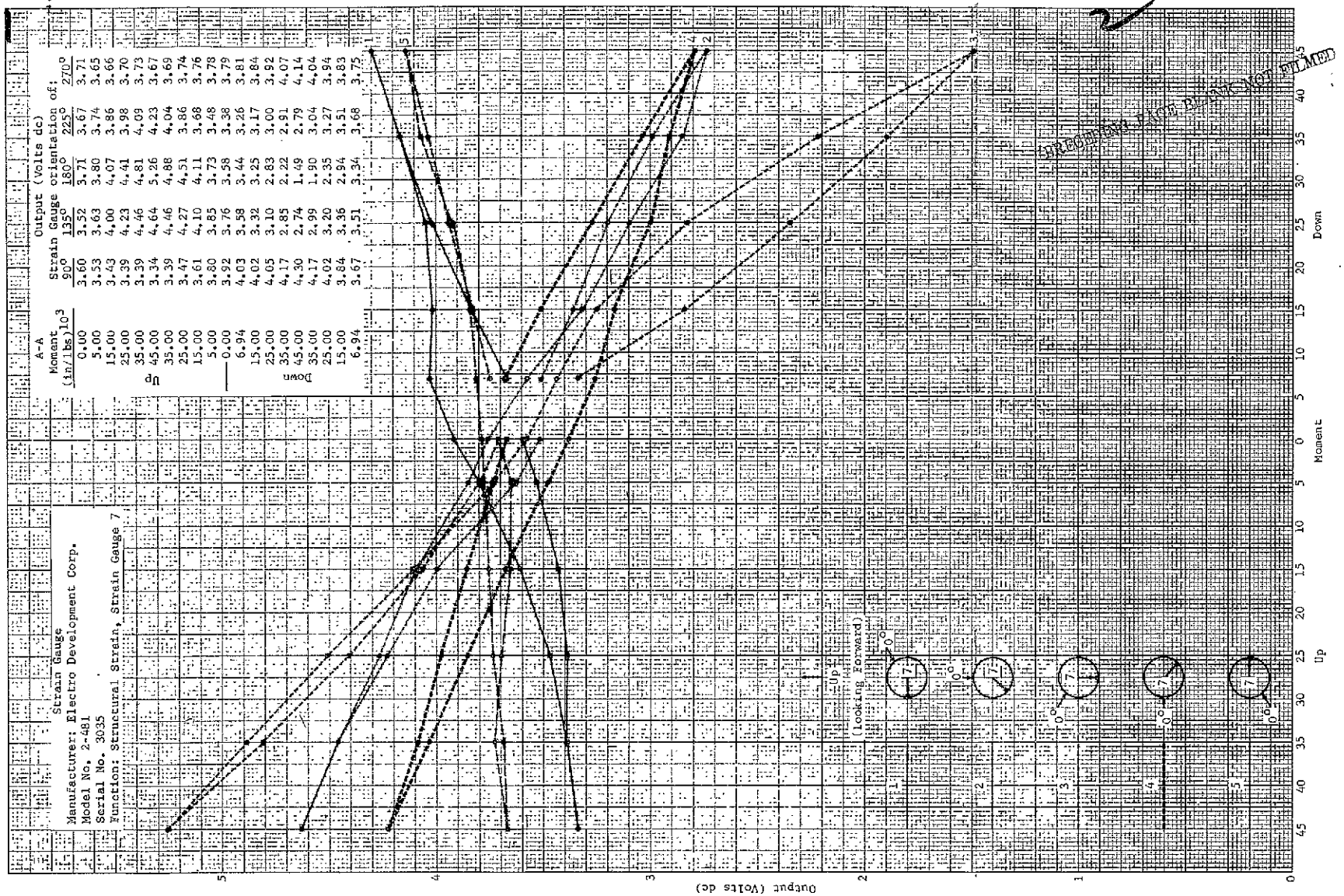


Figure 68. Strain Gauge 7, Calibration at 1 g

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FOLDOUT FRAME

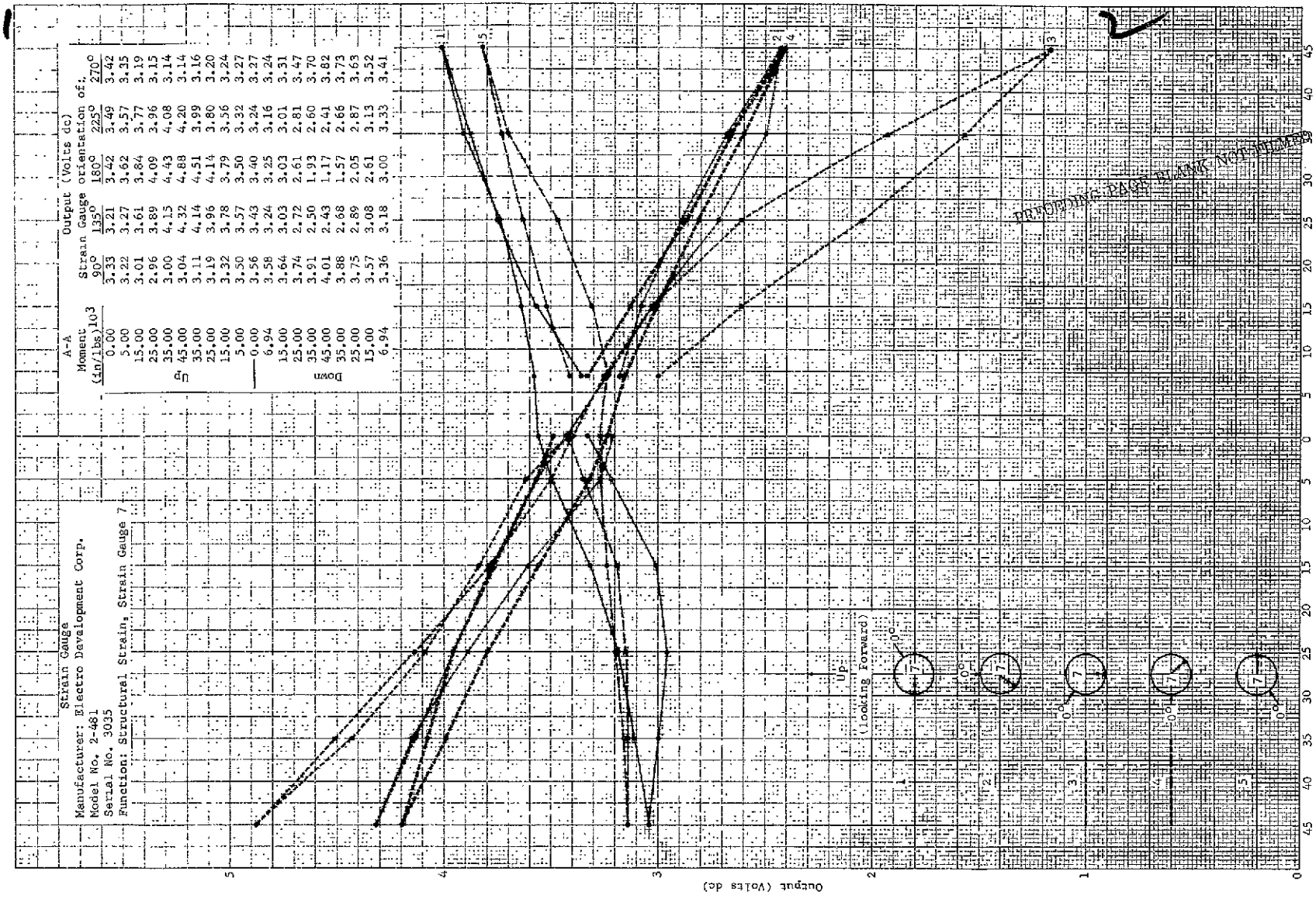

Figure 69. Strain Gauge 7, Calibration at 8 g

FOLDOUT FRAME

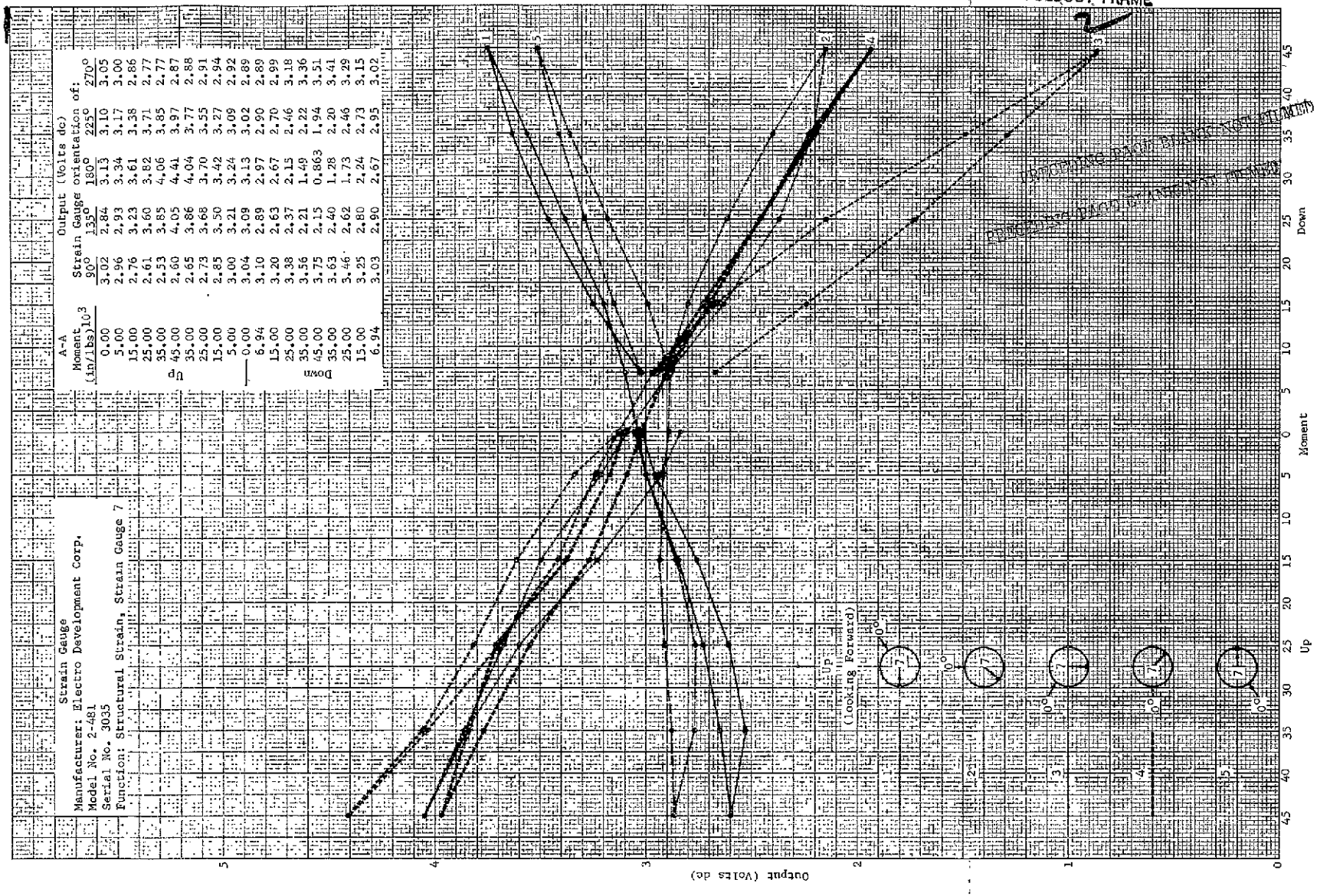

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Figure 70. Strain Gauge 7, Calibration at 15g

FOLDOUT FRAME

FOLDOUT FRAME

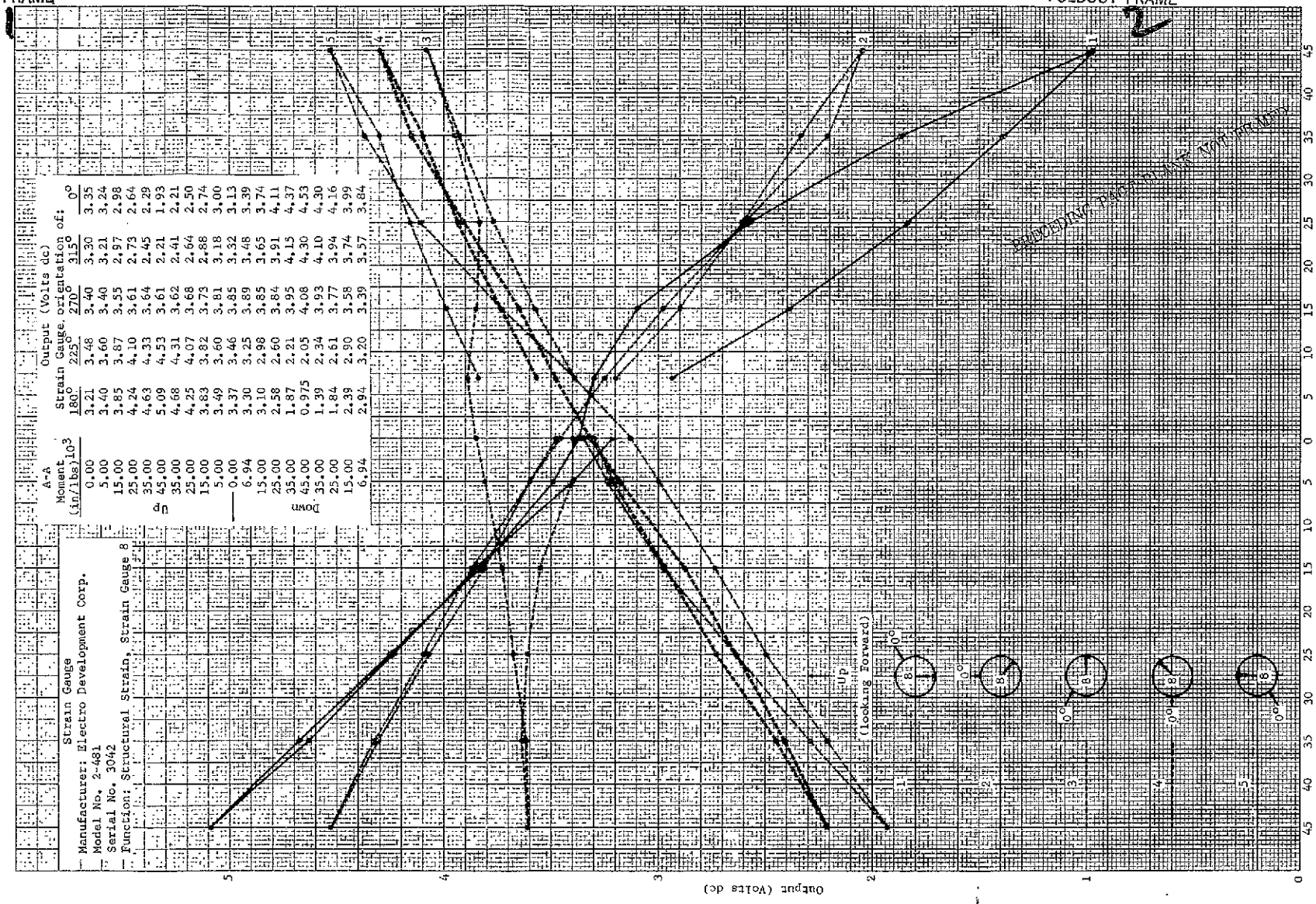
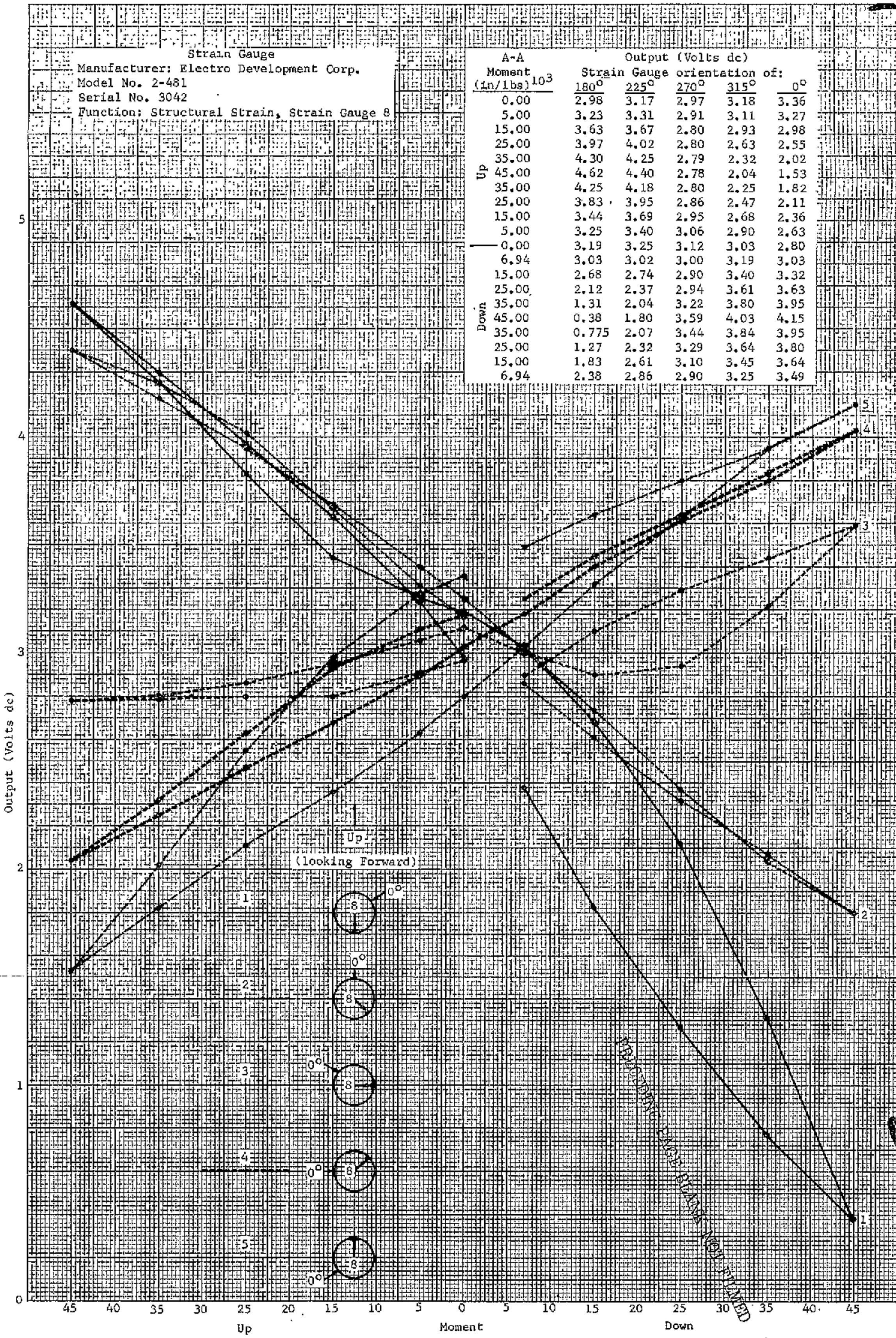


Figure 71. Strain Gauge 8, Calibration at 1 g



A-A Moment (in/lbs)10^3		Output (Volts dc) Strain Gauge orientation of: 180°	225°	270°	315°	0°
Up	0.00	2.98	3.17	2.97	3.18	3.36
	5.00	3.23	3.31	2.91	3.11	3.27
	15.00	3.63	3.67	2.80	2.93	2.98
	25.00	3.97	4.02	2.80	2.63	2.55
	35.00	4.30	4.25	2.79	2.32	2.02
	45.00	4.62	4.40	2.78	2.04	1.53
	35.00	4.25	4.18	2.80	2.25	1.82
	25.00	3.83	3.95	2.86	2.47	2.11
	15.00	3.44	3.69	2.95	2.68	2.36
	5.00	3.25	3.40	3.06	2.90	2.63
	0.00	3.19	3.25	3.12	3.03	2.80
Down	6.94	3.03	3.02	3.00	3.19	3.03
	15.00	2.68	2.74	2.90	3.40	3.32
	25.00	2.12	2.37	2.94	3.61	3.63
	35.00	1.31	2.04	3.22	3.80	3.95
	45.00	0.38	1.80	3.59	4.03	4.15
	35.00	0.775	2.07	3.44	3.84	3.95
	25.00	1.27	2.32	3.29	3.64	3.80
	15.00	1.83	2.61	3.10	3.45	3.64
	6.94	2.38	2.86	2.90	3.25	3.49

Figure 72. Strain Gauge 8, Calibration at 8g

FOLDOUT FRAME

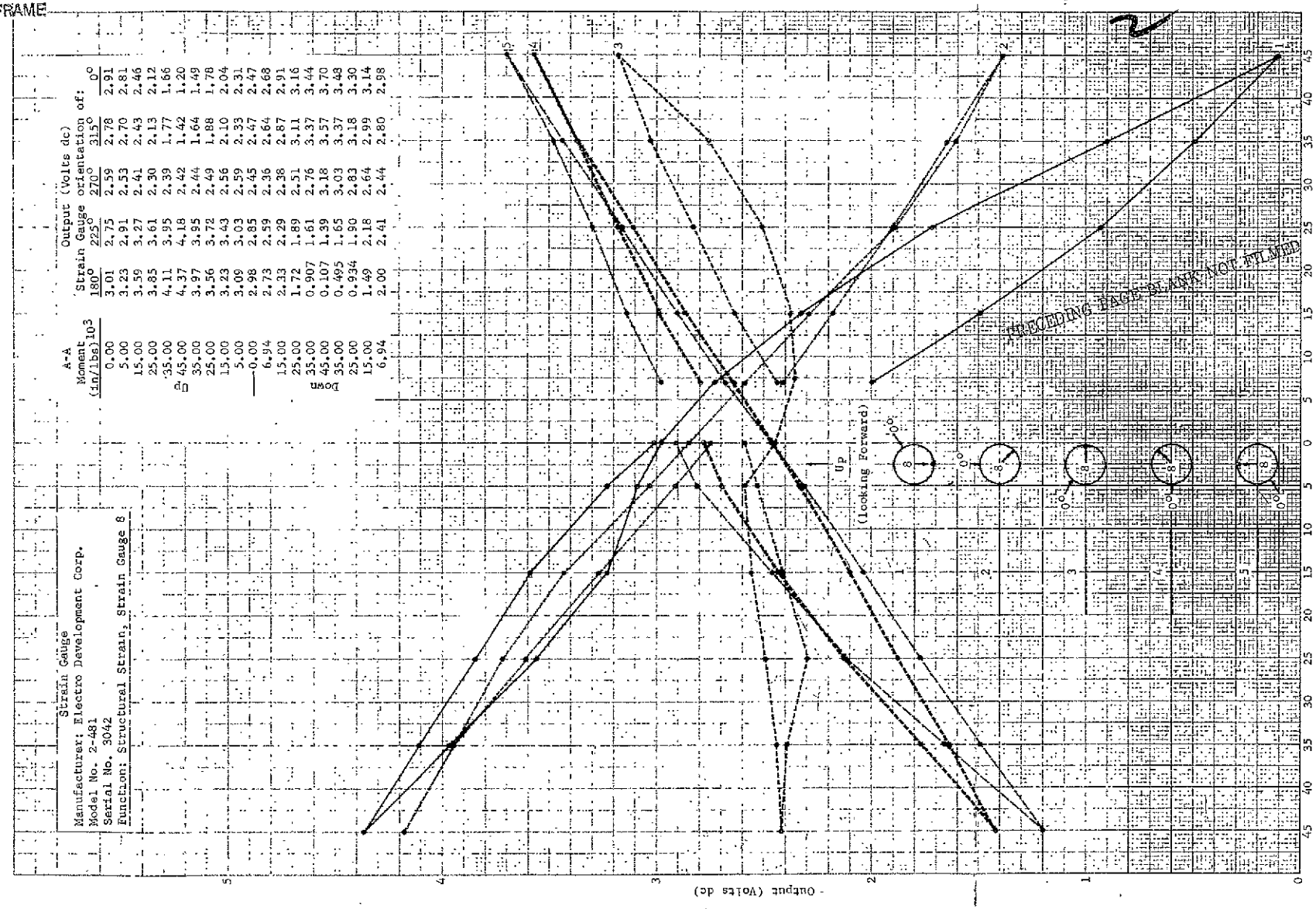


Figure 73. Strain Gauge 8, Calibration at 15g

SECTION VI

TEMPERATURE INSTRUMENTATION

TABLE 21

TEMPERATURE GAUGES USED FOR FLIGHT 17.05 GT-GG

Sensor	Manufacturer	Model No.	Serial No.	Range (degrees F)
Temperature Transducer 1	Trans-sonics	67B	81191	0 to 1200
Temperature Transducer 2	Trans-sonics	67B	81199	0 to 1200
Temperature Transducer 3	Trans-sonics	67B	81195	0 to 1200
Temperature Transducer 4	Trans-sonics	67B	81193	0 to 1200
Temperature Transducer 5	Trans-sonics	67B	81192	0 to 1200
Temperature Transducer 6	Trans-sonics	67B	81190	0 to 1200
Temperature Transducer 7	Trans-sonics	67B	81208	0 to 1200
Temperature Transducer 8	Trans-sonics	67B	81210	0 to 1200
Temperature Transducer 9	Trans-sonics	67B	81209	0 to 1200
Temperature Transducer 10	Trans-sonics	67B	81207	0 to 1200
Temperature Transducer 11	Trans-sonics	67B	81211	0 to 1200
Temperature Transducer 12	Trans-sonics	67B	81204	0 to 1200
Temperature Transducer 13	Trans-sonics	67B	81203	0 to 1200
Temperature Transducer 14	Trans-sonics	67B	81187	0 to 1200
Temperature Transducer 15	Trans-sonics	67B	81202	0 to 1200
Temperature Transducer 16	Trans-sonics	67B	81201	0 to 1200

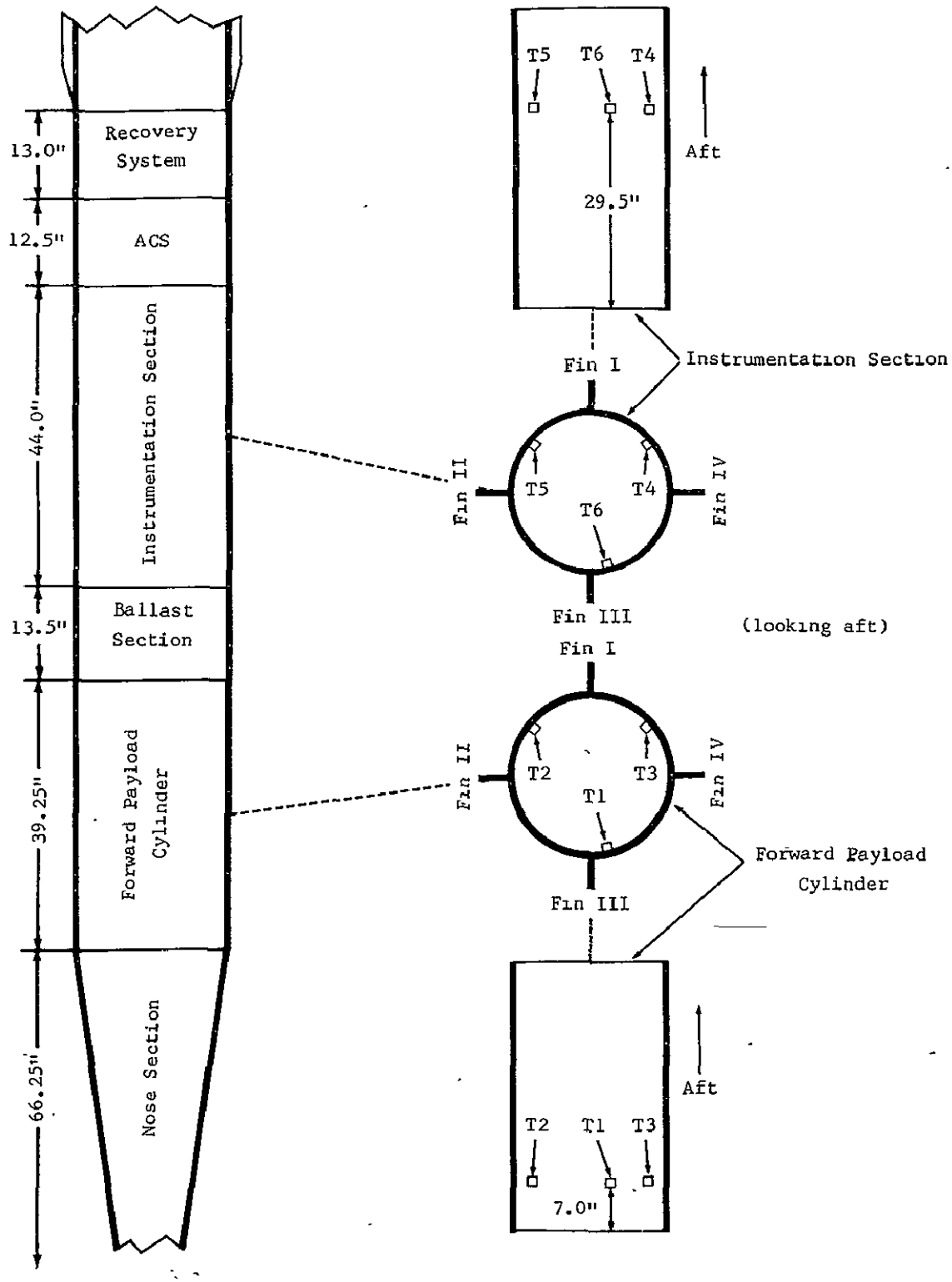


Figure 74. Temperature Transducers (Payload), Orientation on Flight 17.05GT-GG

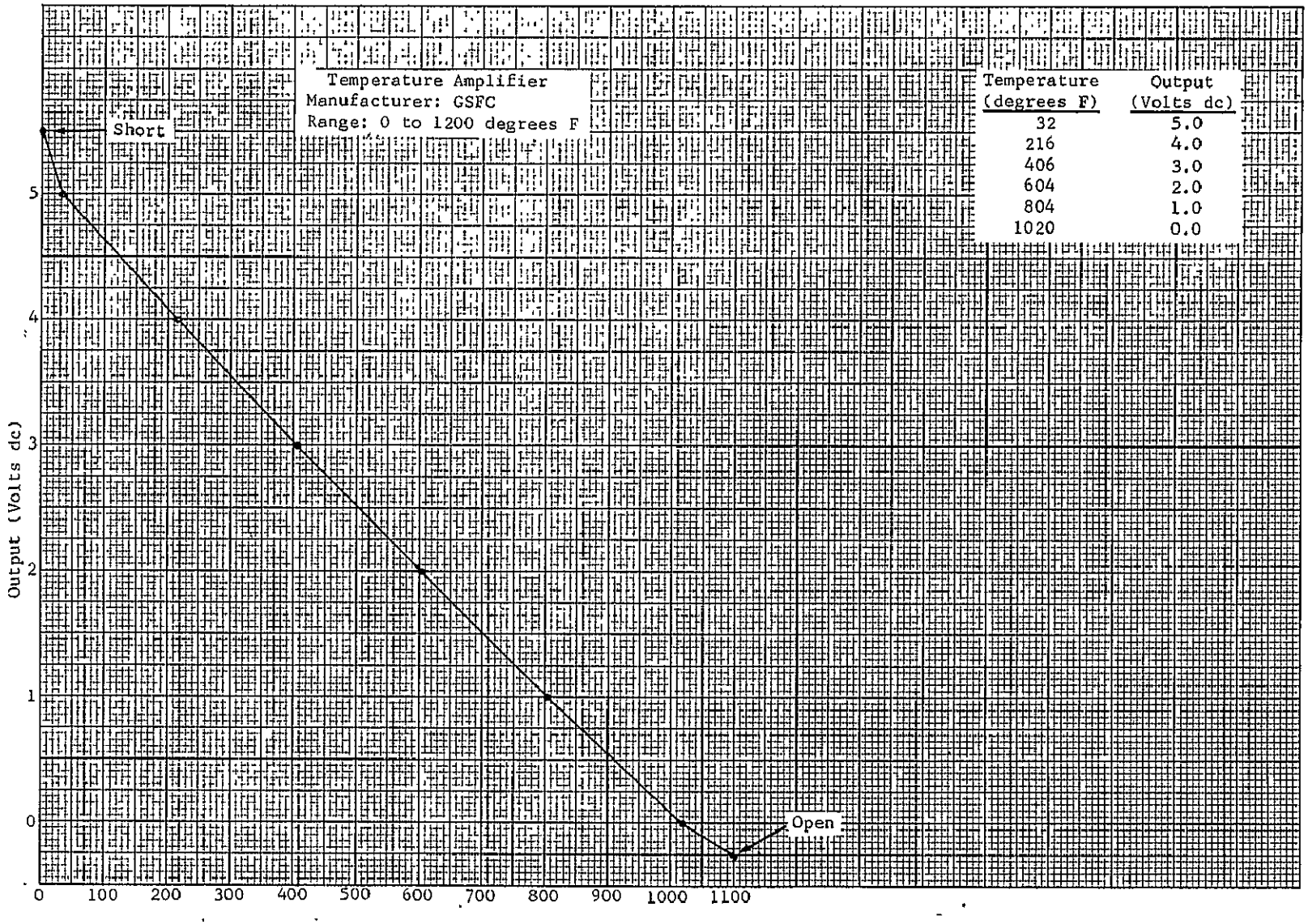


Figure 75. Temperature Amplifier, Calibration

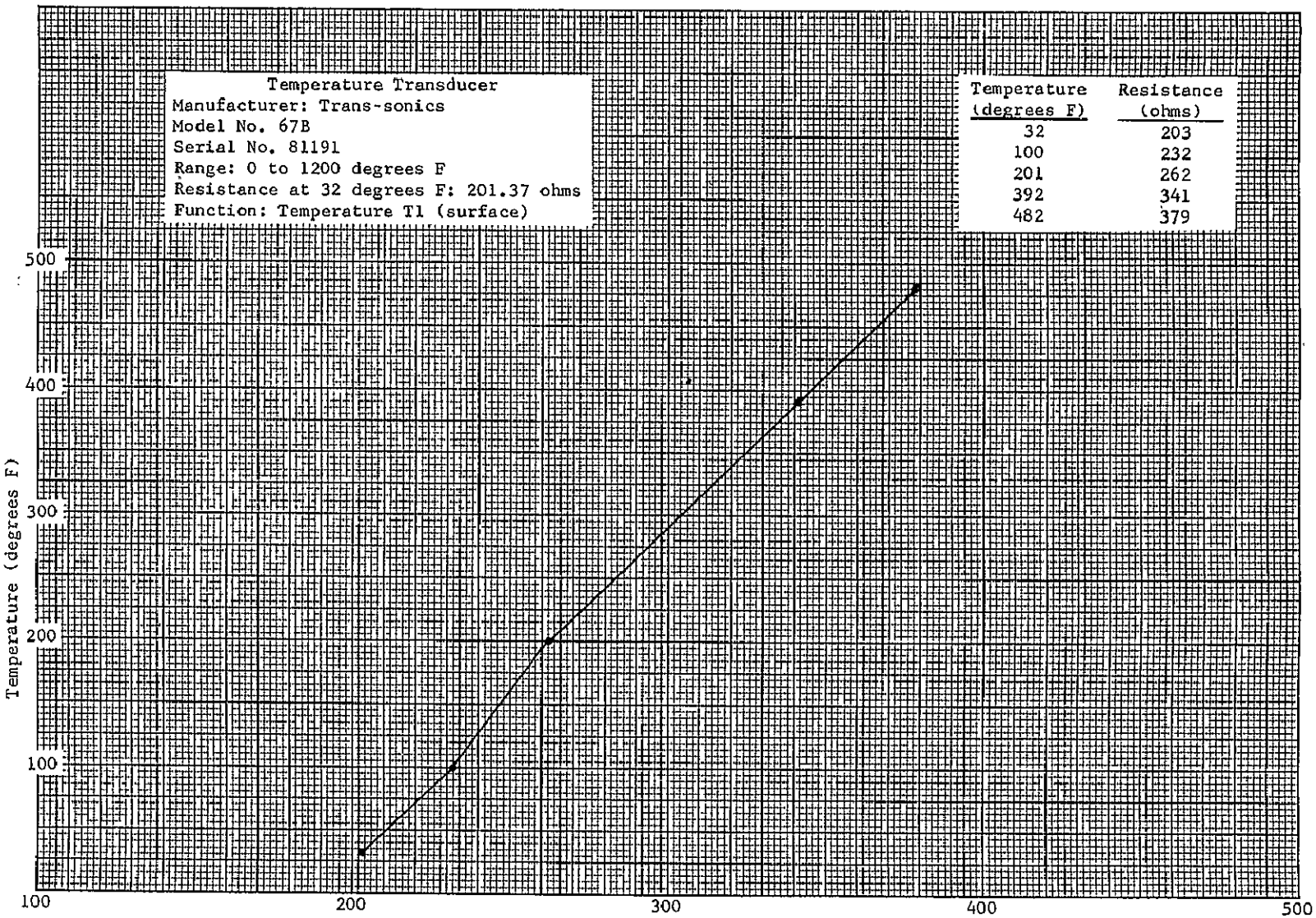


Figure 76. Temperature Transducer T1, Calibration

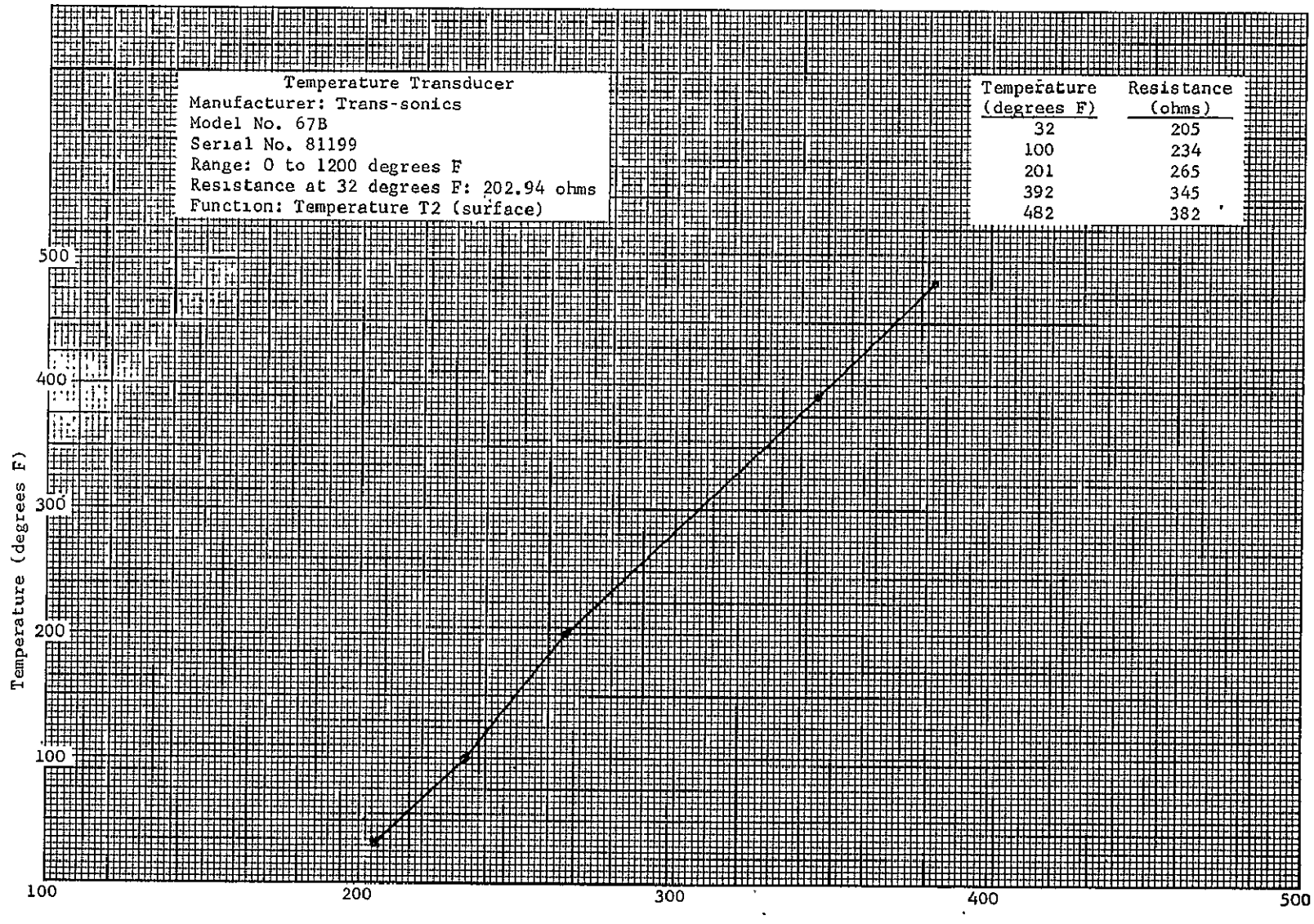


Figure 77. Temperature Transducer T2, Calibration

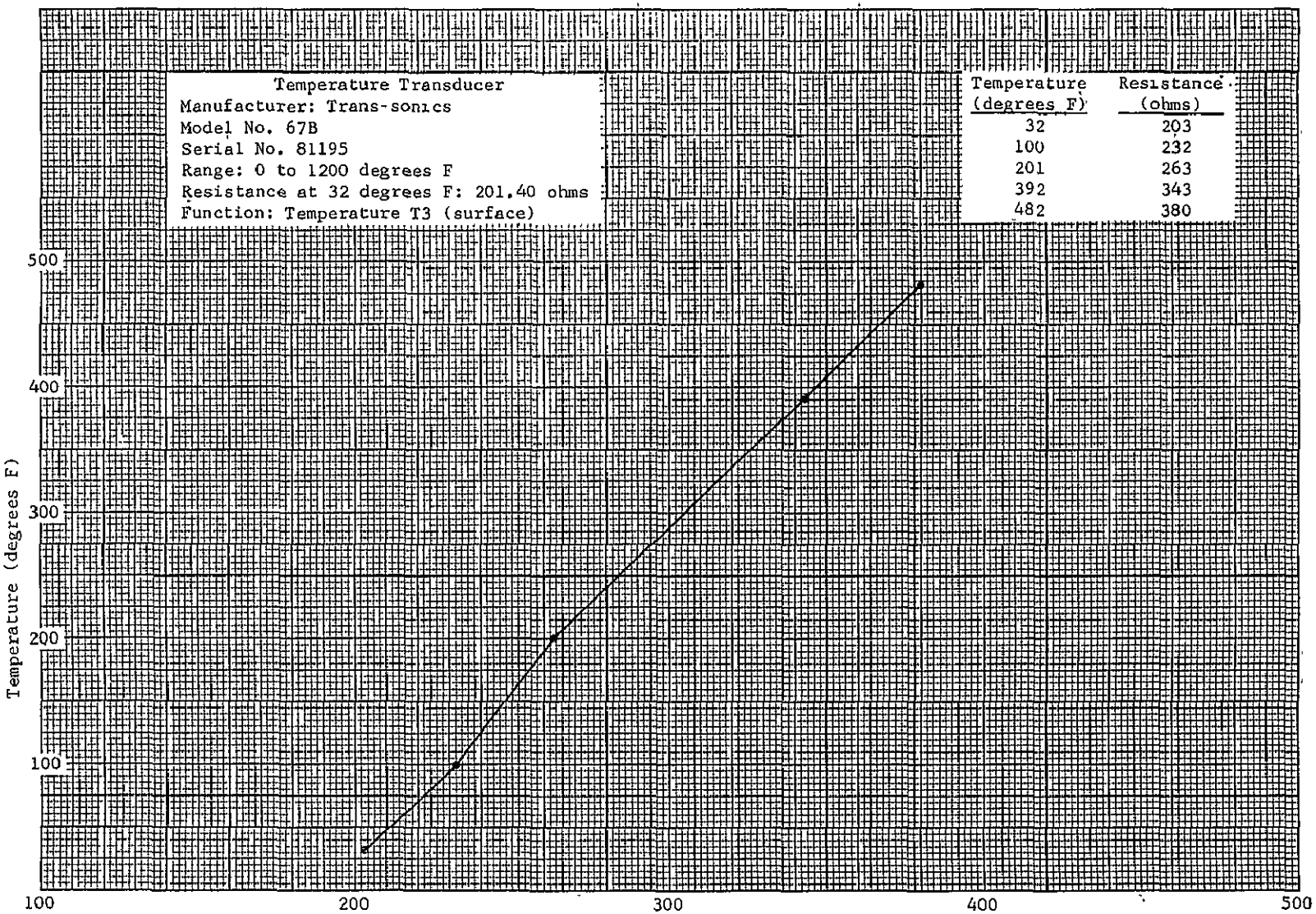


Figure 78. Temperature Transducer T3, Calibration

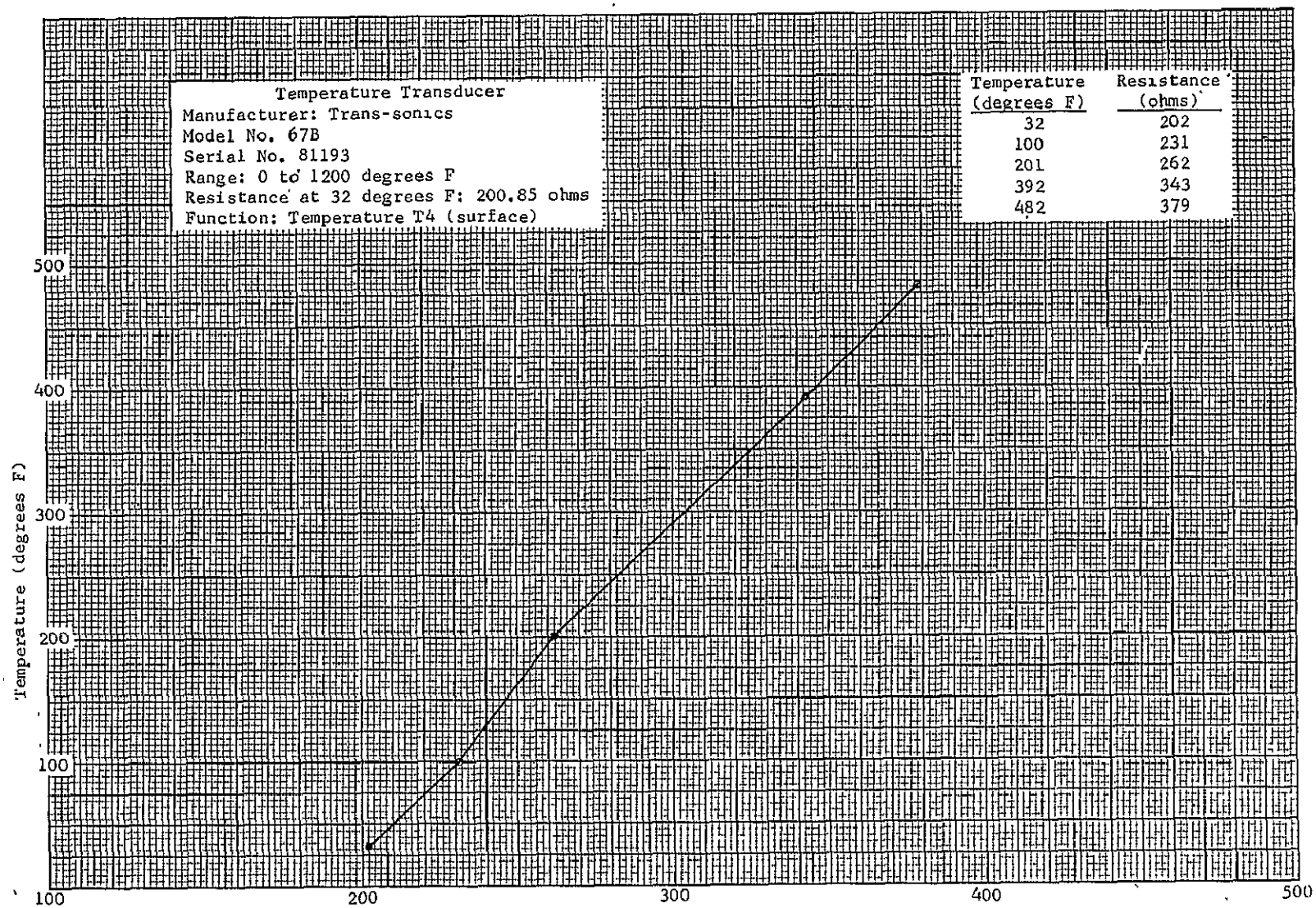


Figure 79. Temperature Transducer T4, Calibration

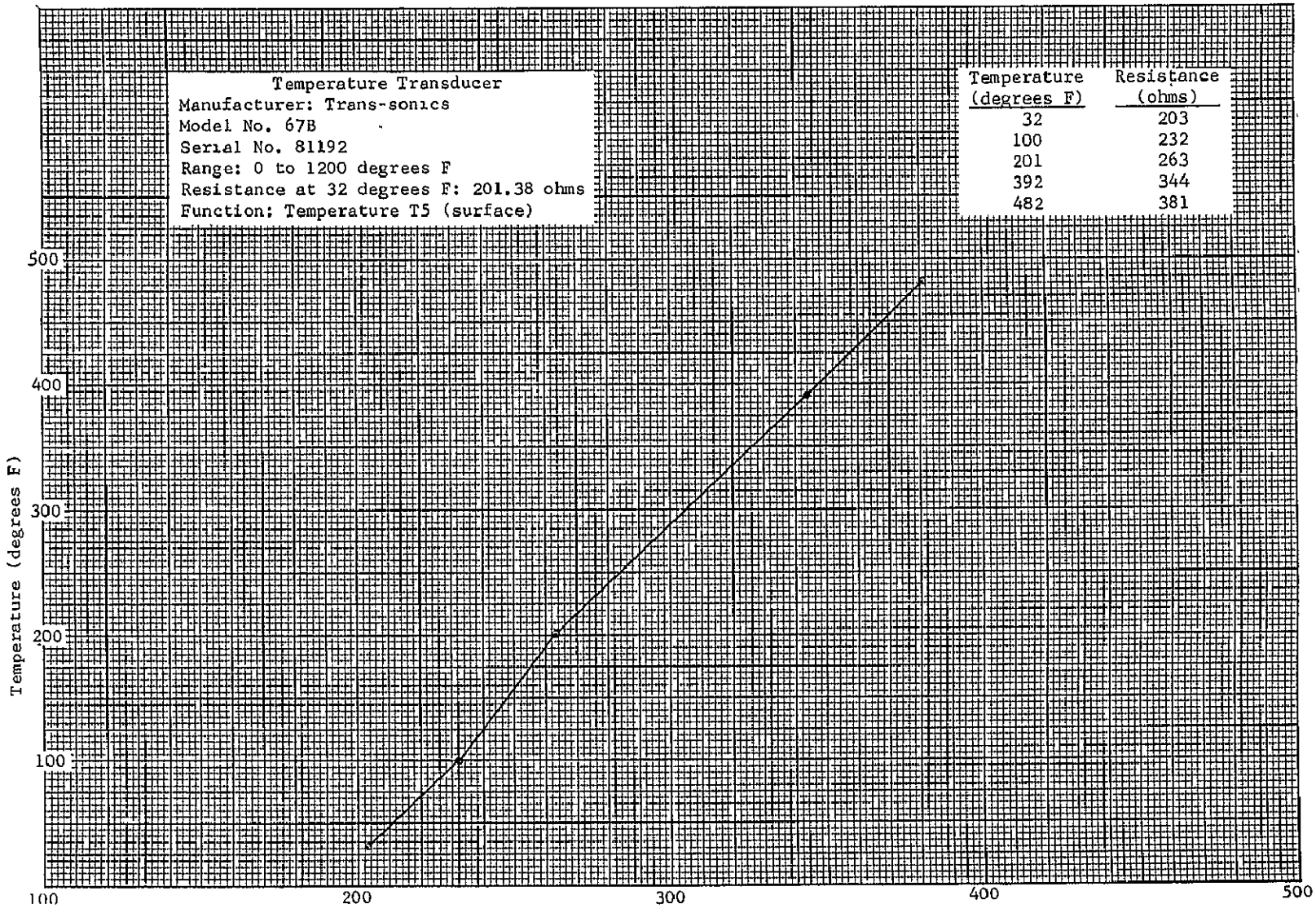


Figure 80. Temperature Transducer T5, Calibration

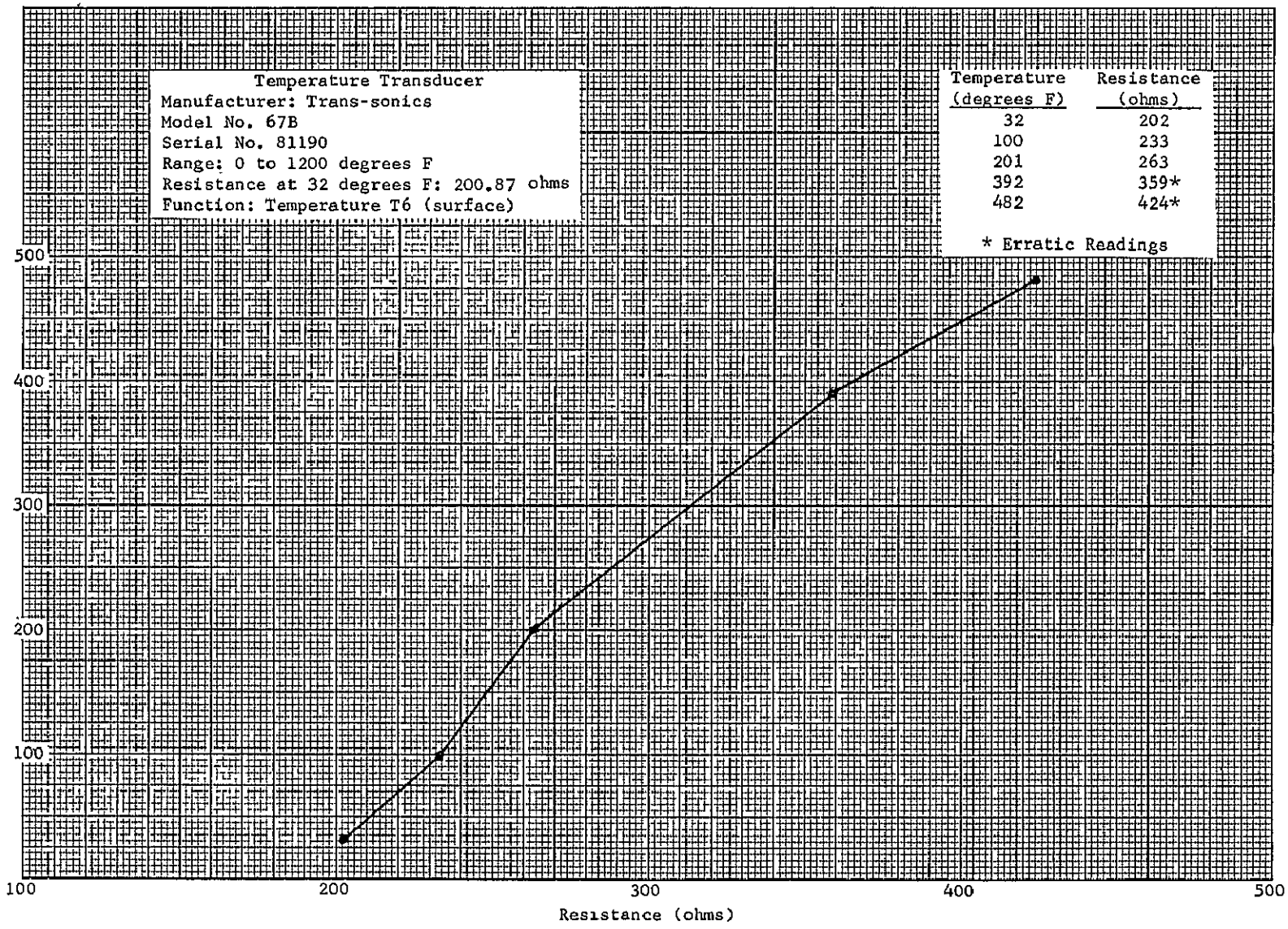
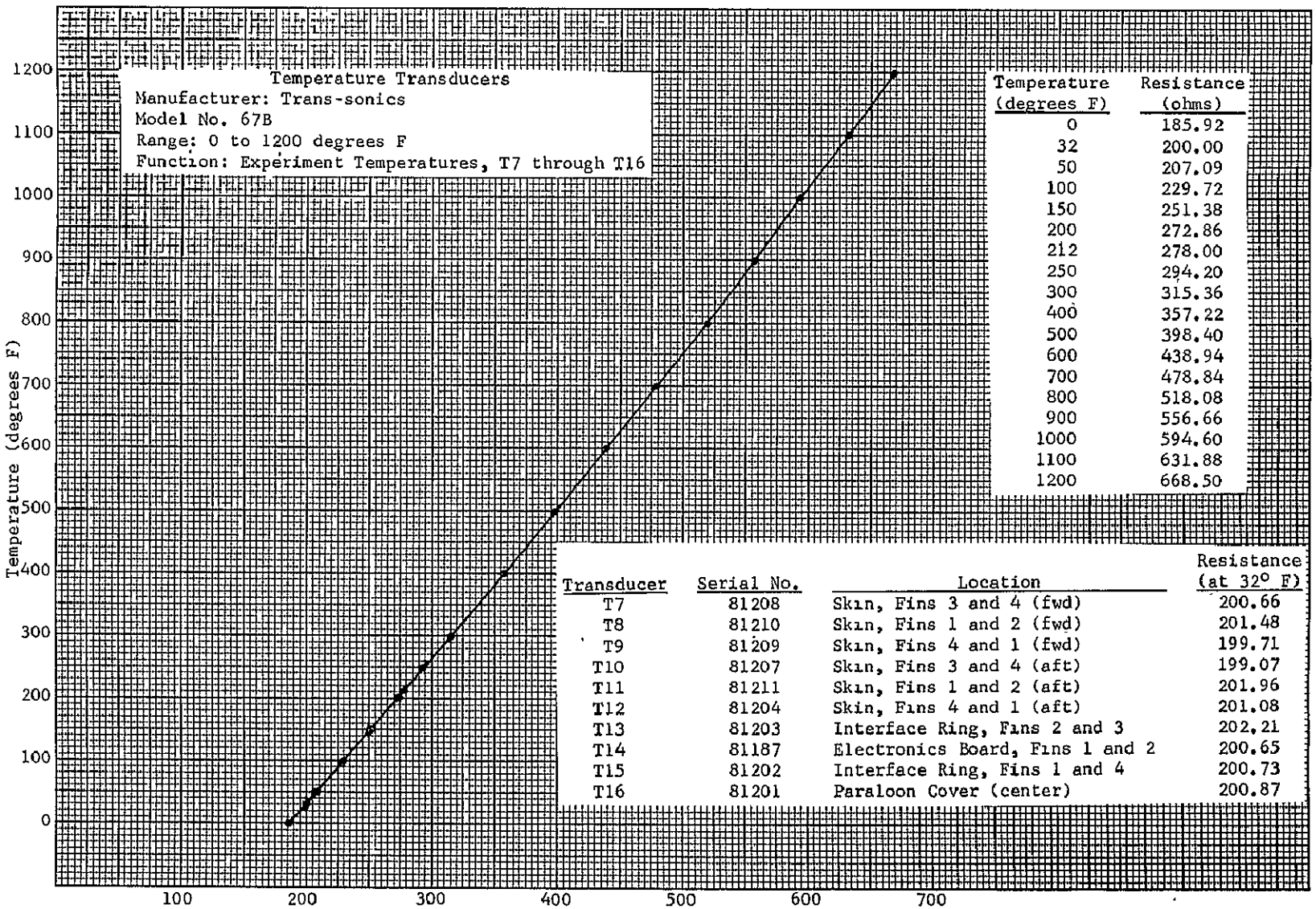


Figure 81. Temperature Transducer T6, Calibration



Temperature (degrees F)	Resistance (ohms)
0	185.92
32	200.00
50	207.09
100	229.72
150	251.38
200	272.86
212	278.00
250	294.20
300	315.36
400	357.22
500	398.40
600	438.94
700	478.84
800	518.08
900	556.66
1000	594.60
1100	631.88
1200	668.50

Transducer	Serial No.	Location	Resistance (at 32° F)
T7	81208	Skin, Fins 3 and 4 (fwd)	200.66
T8	81210	Skin, Fins 1 and 2 (fwd)	201.48
T9	81209	Skin, Fins 4 and 1 (fwd)	199.71
T10	81207	Skin, Fins 3 and 4 (aft)	199.07
T11	81211	Skin, Fins 1 and 2 (aft)	201.96
T12	81204	Skin, Fins 4 and 1 (aft)	201.08
T13	81203	Interface Ring, Fins 2 and 3	202.21
T14	81187	Electronics Board, Fins 1 and 2	200.65
T15	81202	Interface Ring, Fins 1 and 4	200.73
T16	81201	Paraloon Cover (center)	200.87

Figure 82. Temperature Transducers (T7 through T16), Recovery System, Calibration

SECTION VII

VEHICLE ANTENNAS DATA

TABLE 22

VEHICLE ANTENNAS USED ON FLIGHT 17.05GT-GG

Antenna	Manufacturer	Model No.	Serial No.
Telemetry System 1, PAM/FM/FM (244.3 MHz)	New Mexico State	2.041	W78, W79
Telemetry System 2, PPM/FM (240.2 MHz)	New Mexico State	2.041	W76, W77
Telemetry System 3, PCM/FM (258.5 MHz)	New Mexico State	2.041	W80, W81
Telemetry System 4, PAM/FM/FM (232.9 MHz)	New Mexico State	2.041	W74, W75
Command Receiver (409.0 MHz)	New Mexico State	4.003	W84, W85
Tone Range (550.0 MHz)	New Mexico State	4.001	Z94, Z95

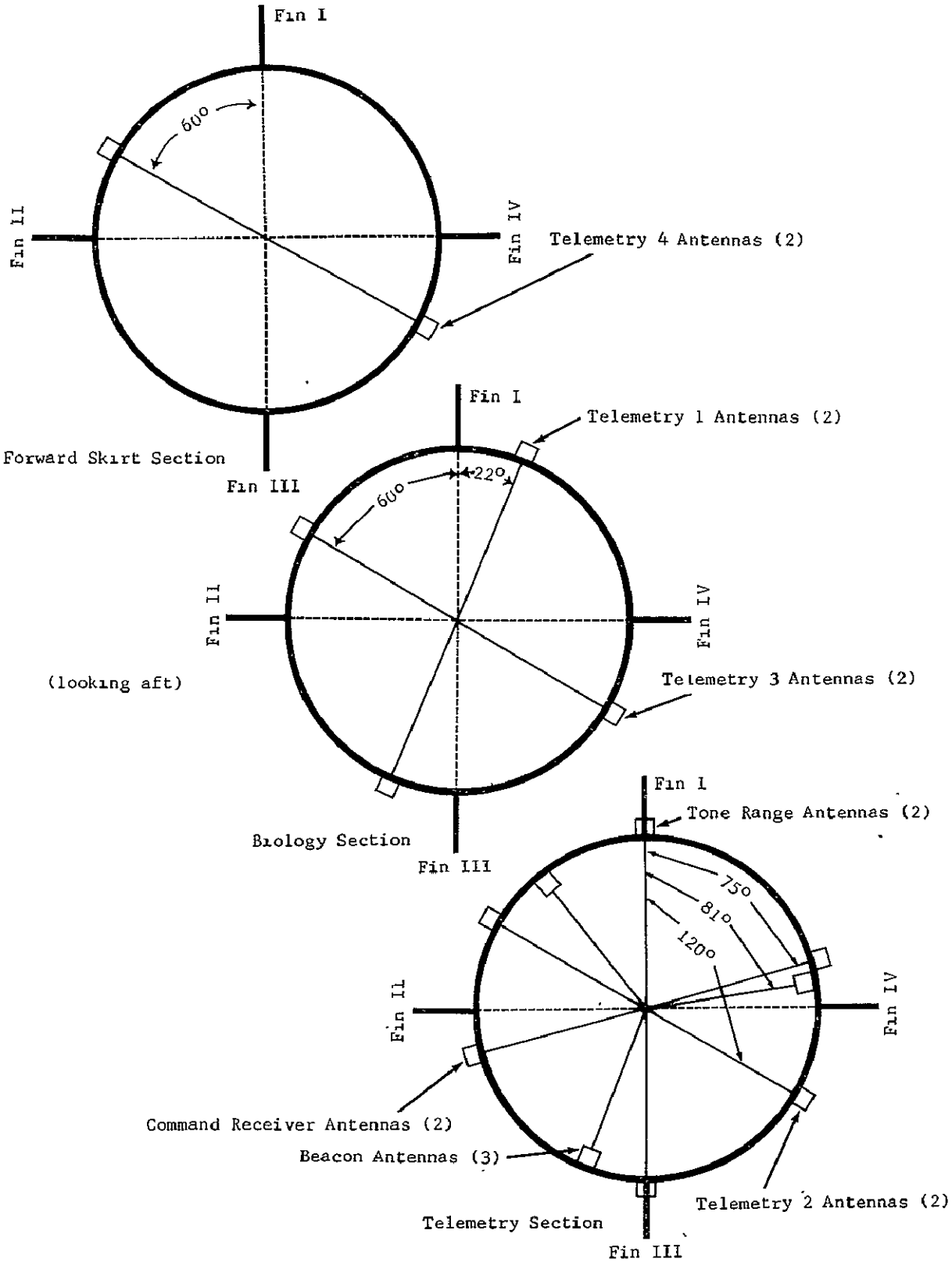


Figure 83. Antennas, Orientation on Flight 17.05 GT-GG

Model No. 2.041
Serial No. W78 and W79

Tuned to 244.3 MHz
Parallel Tuned Curve at "Tee"

DATE July 22, 1968

IMPEDANCE COORDINATES—50-OHM CHARACTERISTIC IMPEDANCE

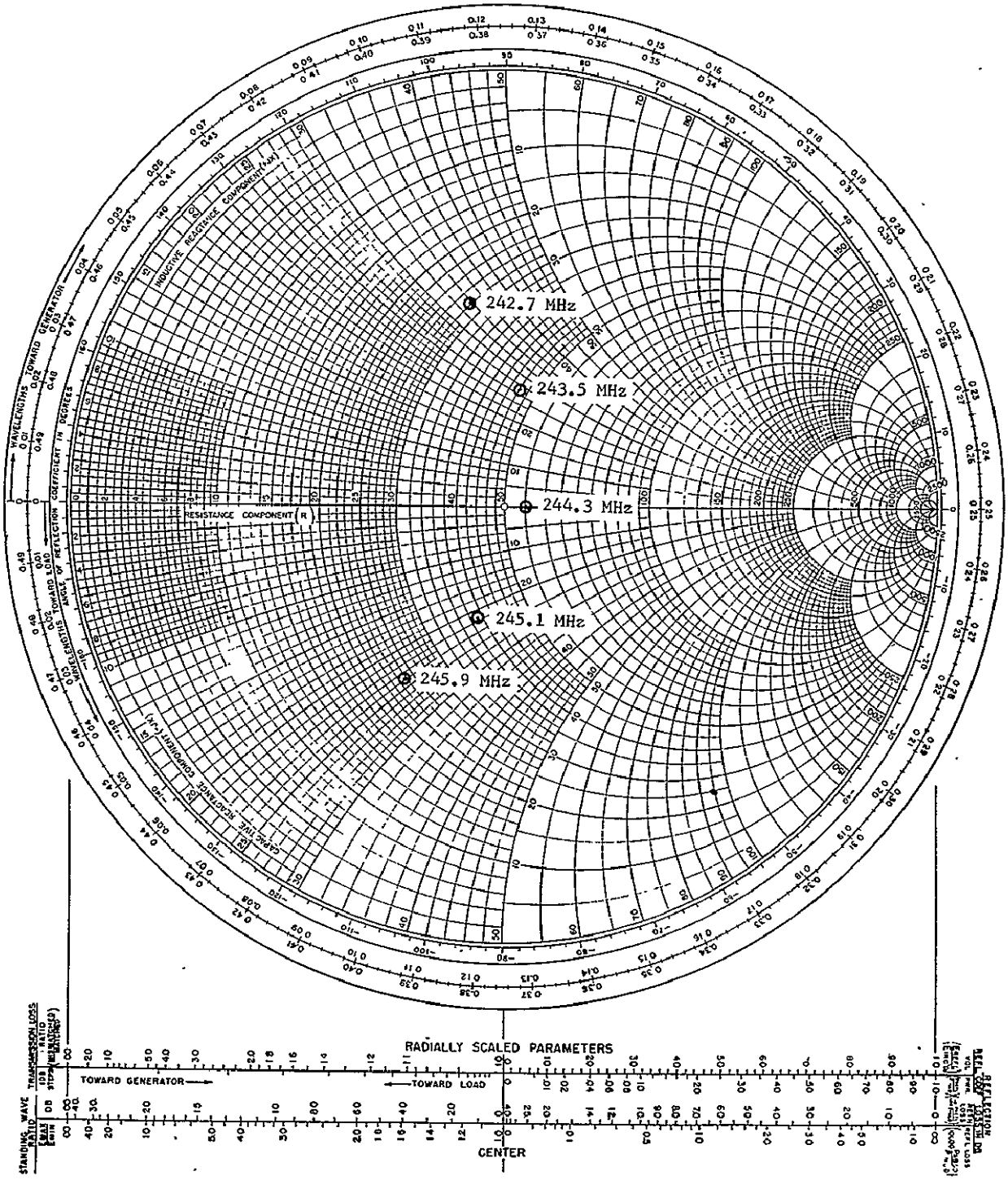


Figure 84. Antennas for Telemetry System 1 (244.3 MHz), Impedance Chart

Model No. 2.041
Serial No. W76 and W77

Tuned to 232.9 MHz
Parallel Tuned Curve at "Tee"

DATE December 2, 1969

IMPEDANCE COORDINATES—50-OHM CHARACTERISTIC IMPEDANCE

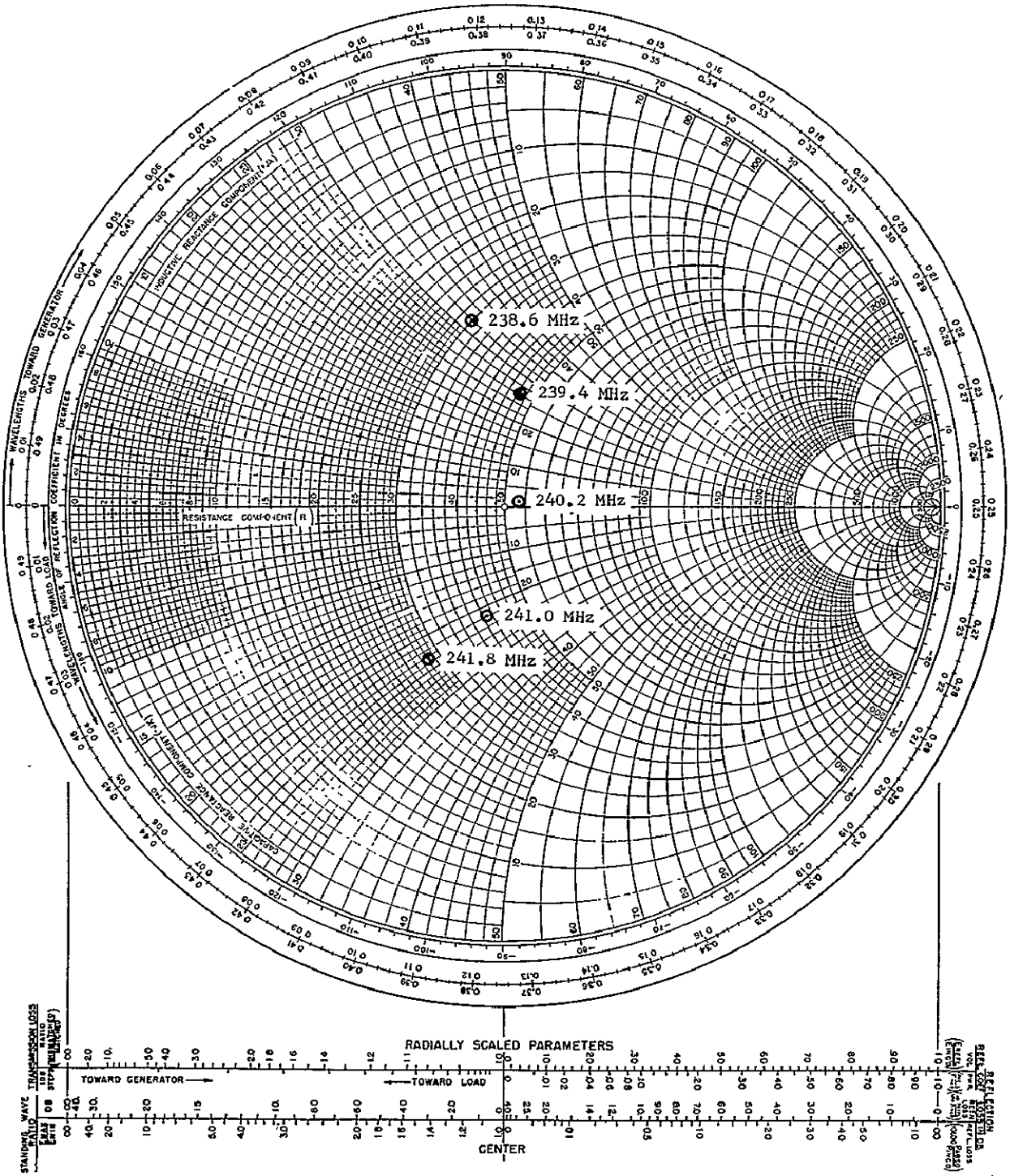


Figure 85. Antennas for Telemetry System 2 (240.2 MHz), Impedance Chart

Model No. 2.041
Serial No. W80 and W81

Tuned to 258.5 MHz
Parallel Tuned Curve at "Tee"

DATE July 22, 1968

IMPEDANCE COORDINATES—50-OHM CHARACTERISTIC IMPEDANCE

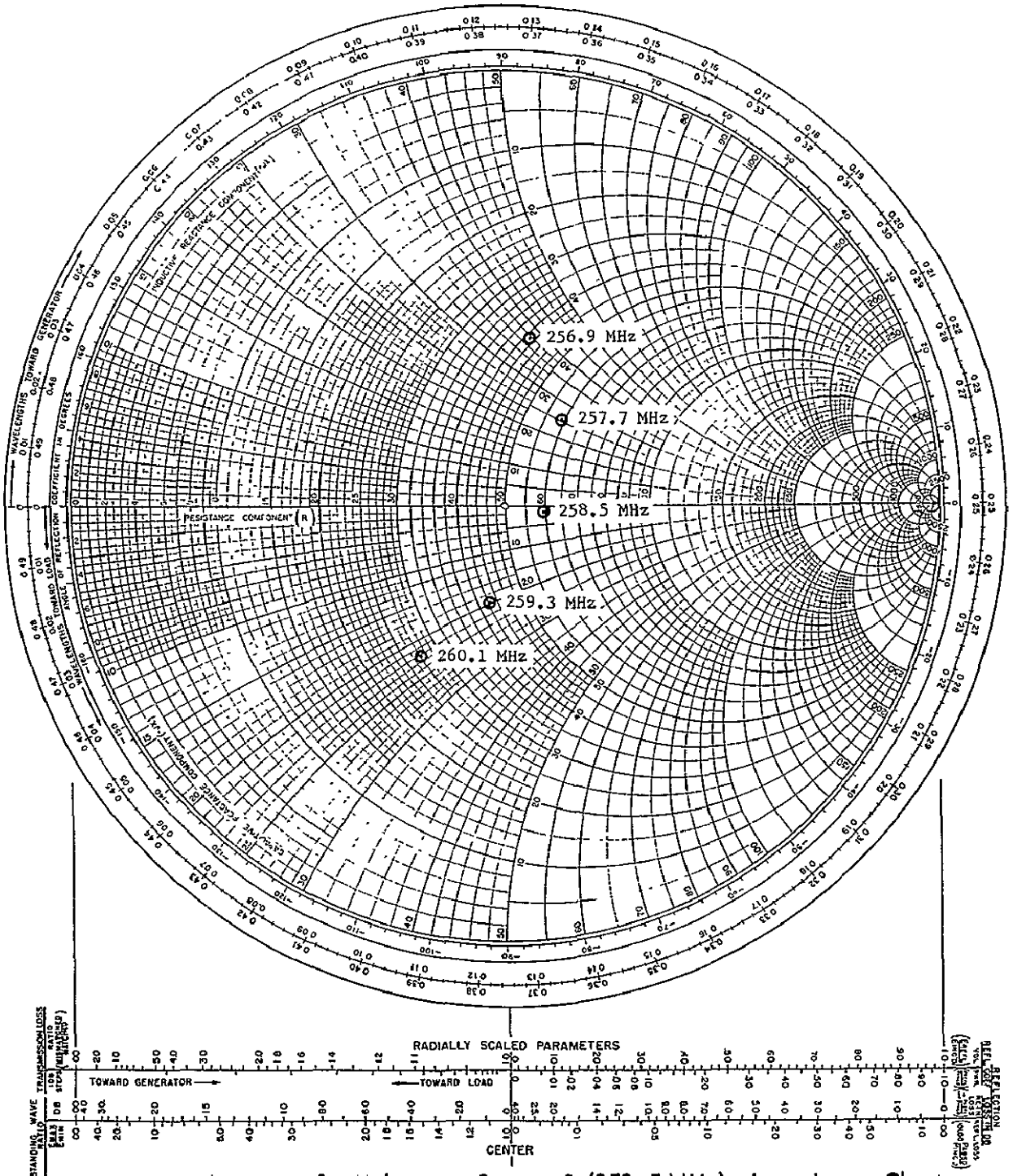


Figure 86. Antennas for Telemetry System 3 (258.5 MHz), Impedance Chart

Model No. 2.041
Serial No. W74 and W75

Tuned to 232.9 MHz
Parallel Tuned Curve at "Tee"

DATE December 2, 1969

IMPEDANCE COORDINATES—50-OHM CHARACTERISTIC IMPEDANCE

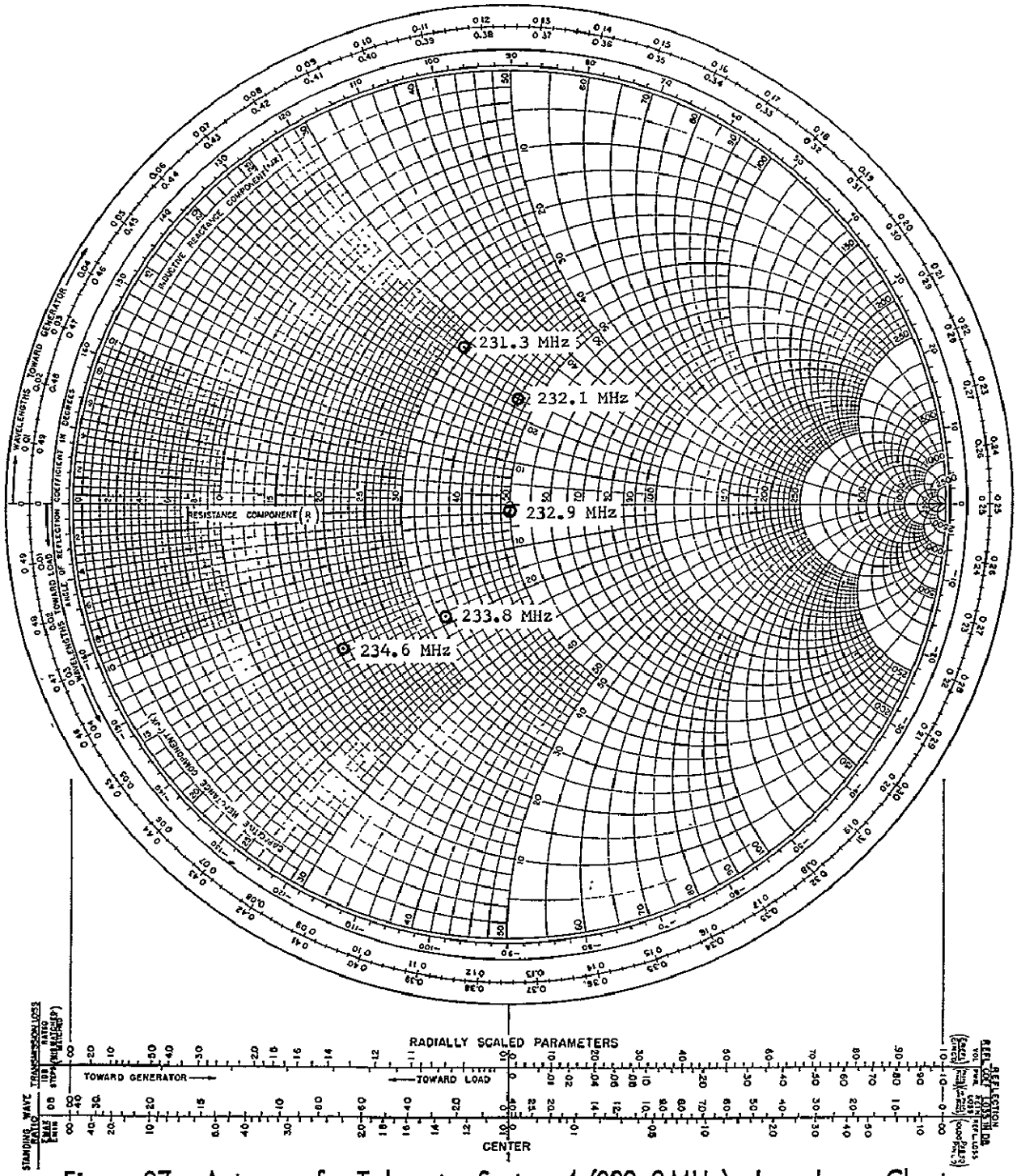


Figure 87. Antennas for Telemetry System 4 (232.9 MHz), Impedance Chart

Model No. 4.003 Tuned to 409.0 MHz DATE July 25, 1968
Serial No. W84 and W85 Parallel Tuned Curve at "Tee"

IMPEDANCE COORDINATES—50-OHM CHARACTERISTIC IMPEDANCE

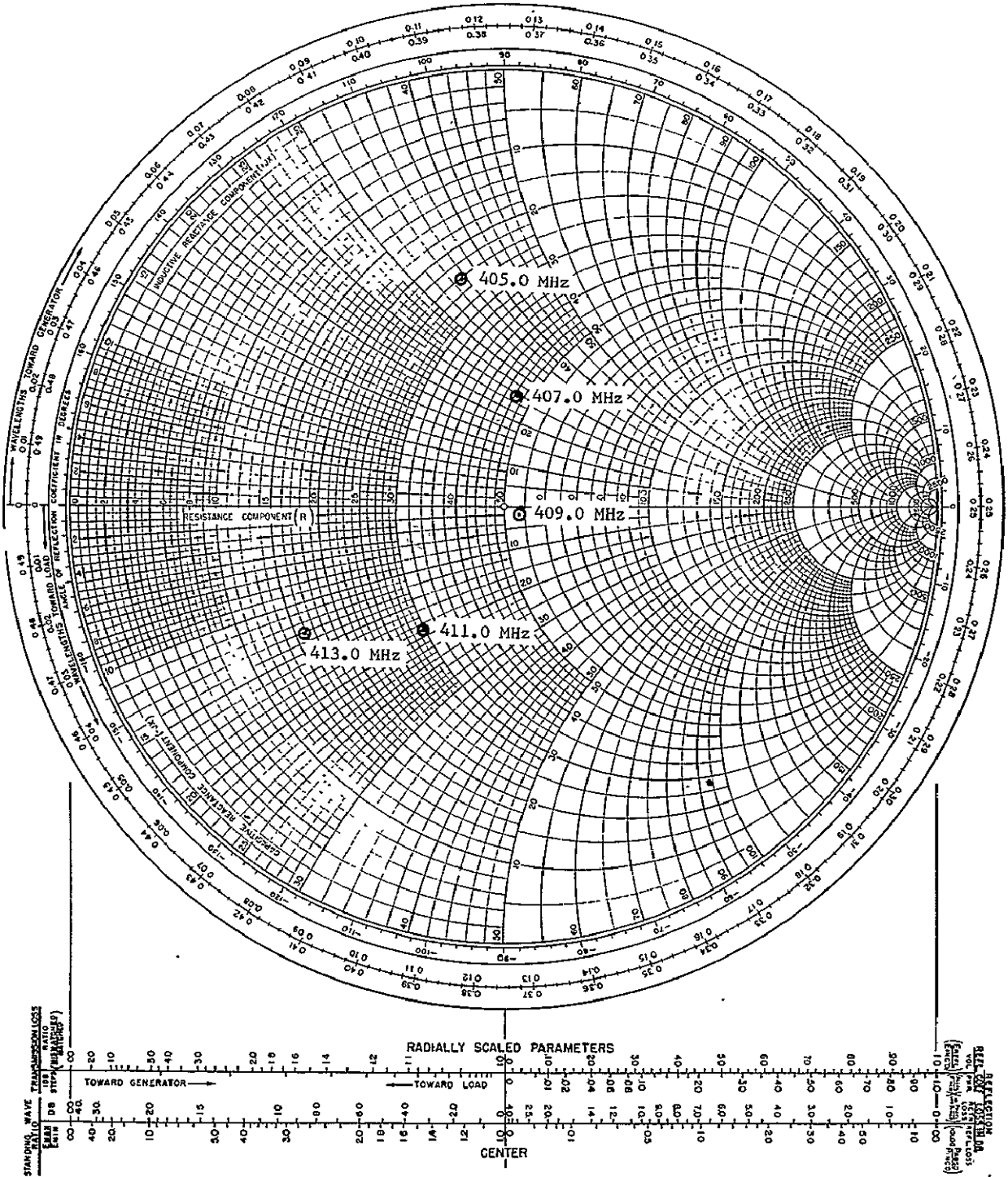


Figure 88. Antennas for Command Receiver (409.0 MHz), Impedance Chart

Model No. 4.011
Serial No. Z94 and Z95

Tuned to 550.0 MHz
Parallel Tuned Curve at "Tee"

DATE August 5, 1969

IMPEDANCE COORDINATES—50-OHM CHARACTERISTIC IMPEDANCE

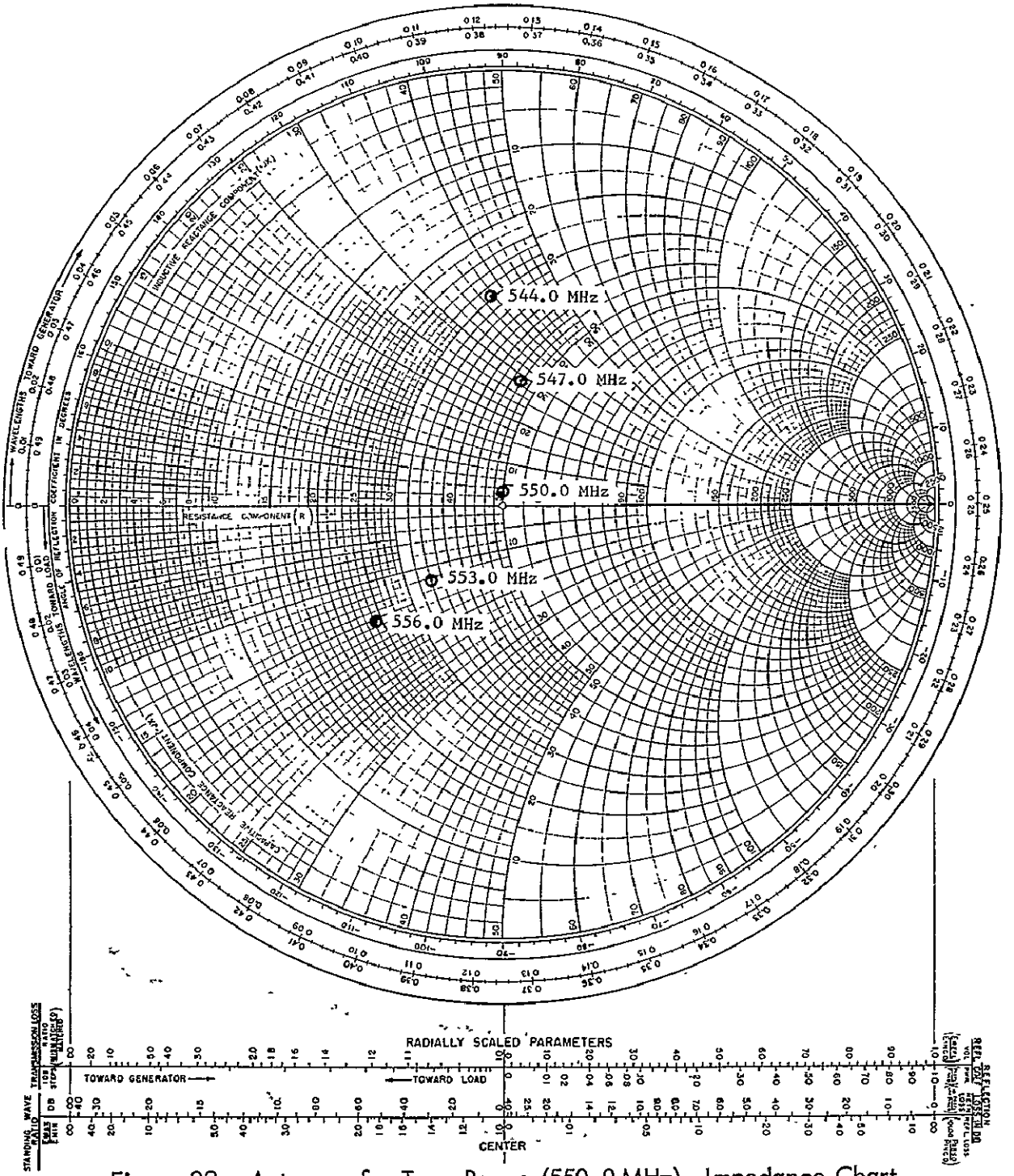


Figure 89. Antennas for Tone Range (550.0 MHz), Impedance Chart